Skyways

Flight Operations
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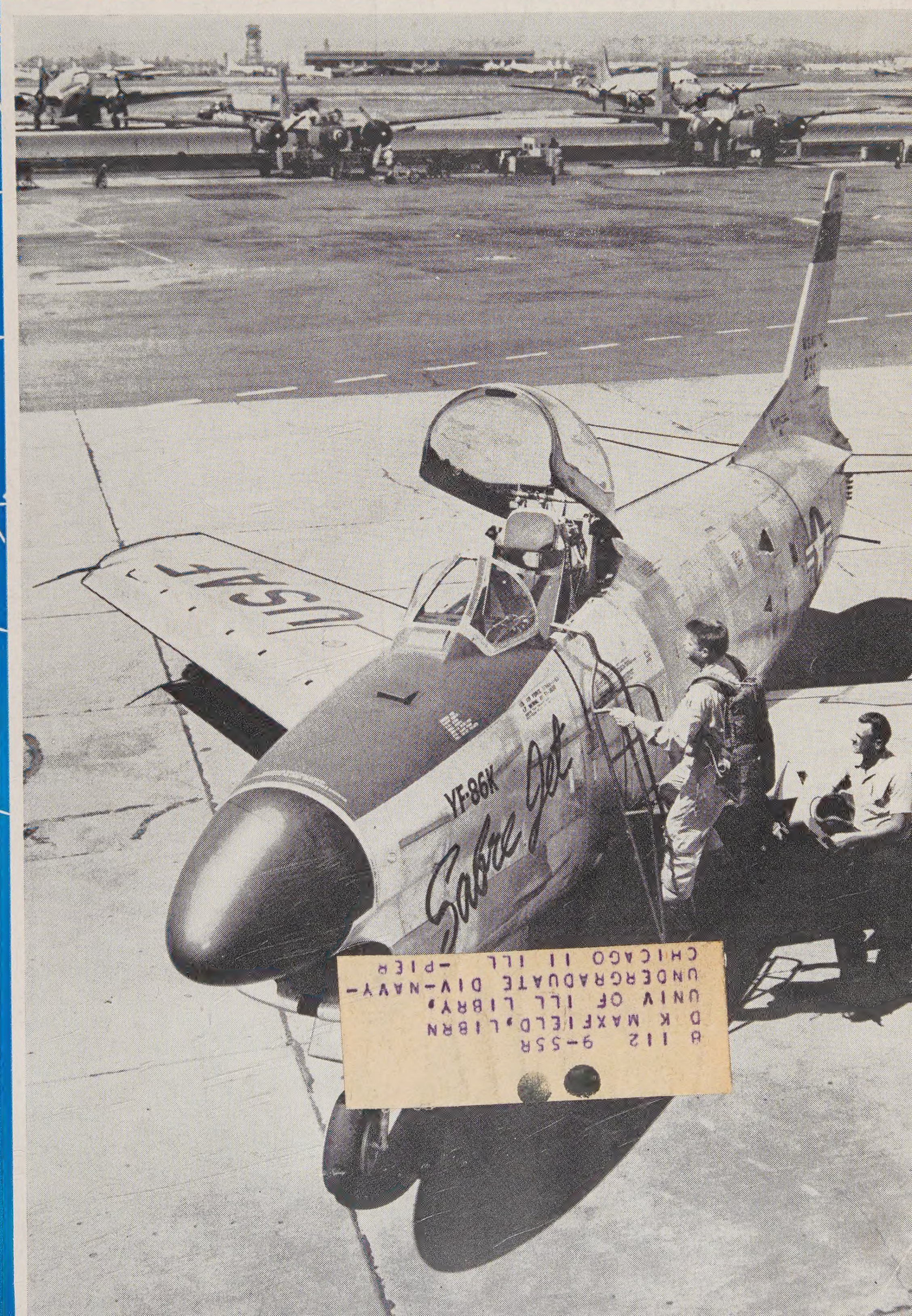
Business
Commercial
Military



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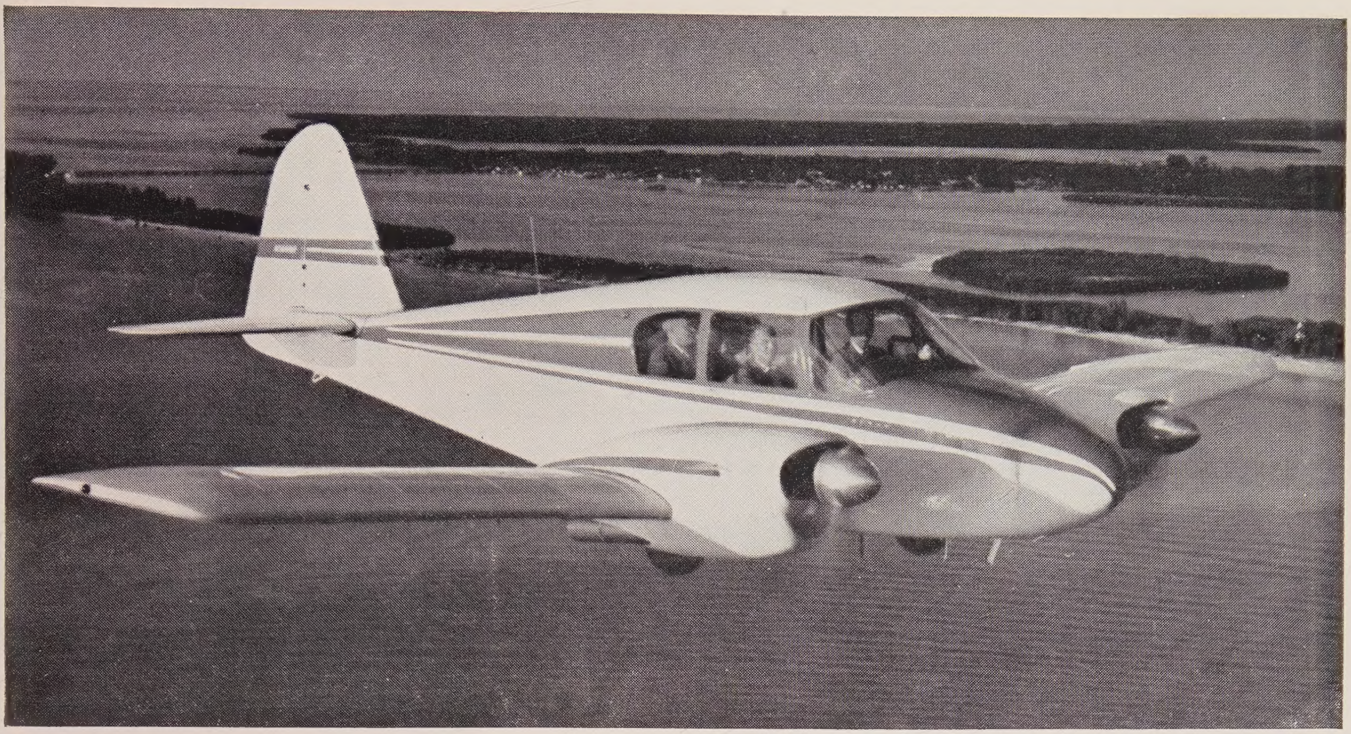


Now Twin-Engine Business Transportation at Practical Cost with the PIPER *Apache*

Now in higher production than any other commercial multi-engine airplane and already in the service of many leading corporations, the twin-engine Piper Apache admirably fills a long-felt requirement for a fast, economical, twin-engine airplane.

Powered with two 150 horsepower Lycoming engines, the Apache cruises 170 mph at optimum altitude yet can land as slow as 52 mph to permit using any existing airport. And since it represents just half the investment of most other twins, there's little wonder that acceptance of the Apache by American business has far exceeded expectations.

If your company already uses single-engine equipment, the Apache might well be the next logical step for round-the-clock utility. If you already operate larger multi-engine equipment, the Apache is an ideal supplement to extend benefits and savings of company air travel to more key personnel more often.

Or if you have not felt, up to this point, that investment in a company airplane was justified, a study of the Apache's unique capabilities, unusual safety features, and substantial money-saving economics may well permit you to revise your estimates.

Your Piper distributor will be glad to help you with such an analysis and demonstrate the Apache to you. For a complete 24-page manual on the Apache write on your letterhead to Executive Sales Department, Piper Aircraft Corp., Lock Haven, Penna.

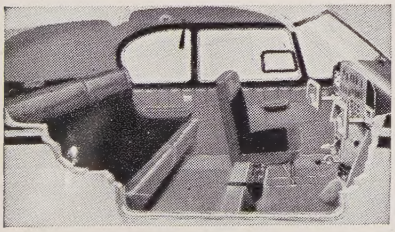
PIPER AIRCRAFT CORPORATION
LOCK HAVEN 5, PENNSYLVANIA

PROVED AND ACCEPTED

Transoceanic flights have *proved* Apache stamina—one flew 3,600 miles non-stop, New York-Paris; a second, non-stop across the North Atlantic; a third, non-stop across the South Atlantic; many to South America. All routine delivery flights!

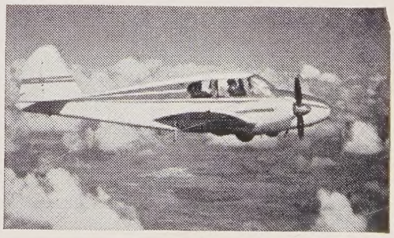
Here are a few of the hundreds of corporations and individuals who now own and operate Piper Apaches:

Ashland Oil & Refining Co.	Ashland, Ky.
Branyan Drilling Co.	Cushing, Okla.
Buttrey Stores, Inc.	Minneapolis, Minn.
Clinton Machine Co.	Maquoketa, Iowa
Crosley Broadcasting Corp.	Cincinnati, Ohio
El Paso Natural Gas Co.	El Paso, Texas
Florida Power & Light Co.	Miami, Fla.
E. & J. Gallo Winery	Modesto, Calif.
C. F. Kettering, General Motors Corp.	Dayton, Ohio
Miller Construction Co.	Windsor, Vt.
Odessa Natural Gasoline Co.	Odessa, Texas
Pursglove Coal Co.	Clarksburg, W. Va.
Reynolds Metals Co.	Richmond, Va.
Sinclair Oil & Refining Co.	Caracas, Venezuela
St. Johnsbury Trucking Co.	St. Johnsbury, Vt.
United Fire & Casualty Co.	Cedar Rapids, Iowa
Uranium Enterprises	Grand Junction, Colo.



Comfort. Wide rear seat and individually adjustable front seats in quiet, luxurious, spacious cabin make Apache travel truly restful for four people.

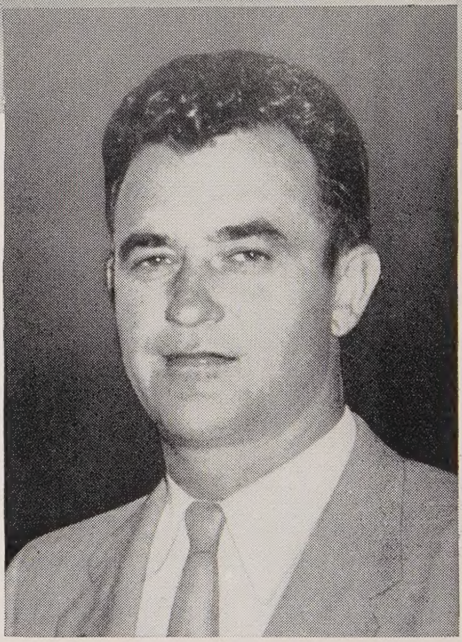
Night and Day. Two dependable engines and full instrumentation give the Apache owner round-the-clock, night and day utility. Cruises 170 mph.



On One Engine, Apache maintains 6,750-foot ceiling at gross load; 8,000 to 10,000 feet with average load. Twin-engine ceiling is 20,000 feet.

Ask the men with the most experience . . .

ask **Carl C. Forrester, Jr.,** chief pilot for E. T. Barwick Mills, Chamblee, Georgia



Chief Pilot Forrester flies a Lockheed, one of a fleet of ships operated by the E. T. Barwick Mills, world's largest producers of cotton and man-made fiber carpets.

"My company," says Mr. Forrester, "has sworn by Gulf since first obtaining aircraft. I personally have used Gulf products for 18 years. And I believe Gulf's Aviation Oils are the best that money can buy. I can really depend on Gulf oils for a safe and trouble-free flight.

"Gulf Aviation Gasoline, too, has always been a top-quality fuel for my money. Now—with *Micronic Filtration* right at the pumps, it's a cleaner, safer-flying fuel than ever. I get Gulf Aviation products wherever available."

GULF
AVIATION PRODUCTS

Gulf Oil Corporation
Gulf Refining Company

Try these trusted Gulf-quality oils!

If your plane is powered with a horizontally opposed or Ranger in-line engine, your best bet is *Gulfpride Aviation Oil, Series-D.* It's a detergent dispersant oil that cuts down ring- and valve-sticking, high oil consumption, oil-screen clogging, and plug fouling. Pilots who use it say it stretches the time between overhauls as much as 100%.

To get best results with a radial engine, or one that doesn't need a detergent oil, use *Gulf Aircraft Engine Oil—Series-R.* It retards sludge and carbon formation, and retains its body at high operation temperatures. Pratt & Whitney and other aircraft engine manufacturers approve it for all types of services in radial engines.

AND Gulf Aviation Gasoline . . . it comes to you "refinery-clean"—for your safety—from pumps with advanced *Micronic Filters.*

JUNE, 1955

Skyways

The Magazine of Flight Operations

COVER: North American F86K

FOUNDED BY J. FRED HENRY, 1942

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industry notes...

■ The Air Force has accepted the turbine-powered XH-13F Bell helicopter and is now in the process of putting the copter through final testing at the Bell factory in Fort Worth. The test program is a joint Air Force-Army development project. The XH-13F is powered by a Turbomeca gas turbine engine built in this country by Continental Aviation and Engineering, Detroit.

■ Northwest Airlines' *Stratocruiser* No. 703 is now equipped with nickel-plated prop blades on its No. 4 engine. The nickel plate, put on over the zinc plate, increases the weight of each blade by about 4 lbs (16 lbs per prop), but the newly covered blades are expected to withstand abrasion better than those blades with just the standard zinc plating. All new Hamilton-Standard *Stratocruiser* propeller blades purchased by NWA will be nickel-plated; blades on hand will remain zinc-plated. Cost-wise, the nickel-plated blades cost about $250 more than the zinc, thus boosting the price of each blade to $3,720 or $14,880 for four blades.

■ Power steering has now been extended to aircraft. A stationary field electric clutch, manufactured by Warner Electric Brake & Clutch Co., Beloit, Wis., has been mounted on some models of the de Havilland *Otters*, thus allowing power steering of the tail wheel. In operation, under normal circumstances with the clutch de-energized, the tail wheel moves freely. However, should the tail wheel become imbedded in mud or snow so that it cannot be turned in the proper direction for taxiing, the pilot energizes the drive motor and clutch with a flick of a switch and the drive motor brings the wheel into phase with the rudder. According to Warner officials, the new clutch may be installed on virtually every type of commercial aircraft now built.

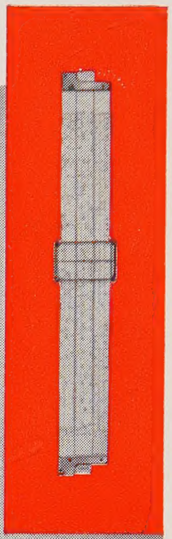
■ Cornell Aeronautical Laboratory has announced that its USAF research program on the North American F-100 *Super Sabre* includes studies at faster-than-sound speeds in a range where measurements on the airplane have never before been taken. The F-100 will have more than 100 hours of flight testing by the Laboratory's Flight Research Department. The jet fighter has been in the lab's hanger for months for instrumentation and soon will be flown to Edwards AFB for the flight testing. Cornell's Chief Pilot John C. Seal and pilot Robert Watts will do the actual flying.

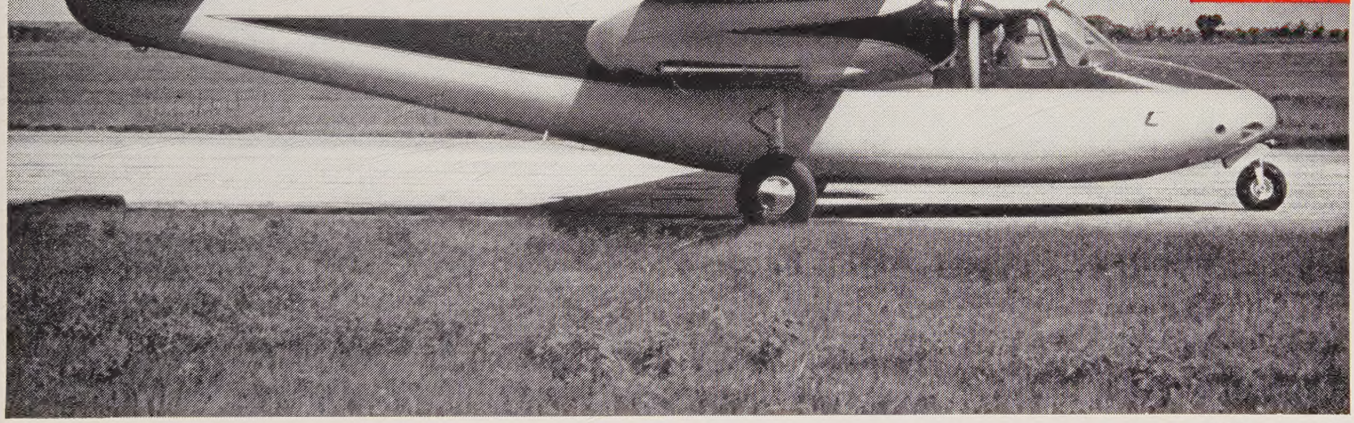
■ TWA engineers working with the Dynamometer Division of the Clayton Manufacturing Co., El Monte, Calif., have come up with a powerless aircraft engine testing development which permits testing under safer, more efficient, less costly and virtually noiseless conditions. Briefly, power from the engines being tested is absorbed in hydraulic devices (called dynamometers) which simulate the load of aircraft propellers under all flight conditions. By this fall, TWA expects to have five such test units in operation at its new engine test facility now under construction at Mid-Continent International Airport at Kansas City, Mo.

■ Pastushin Aviation is now employing a newly developed automatic technique in the fabrication of glass-plastic jettisonable fuel tanks for aircraft. Fabricated from thermosetting resin reinforced by chopped glass rovings, the new tanks are non-corrosive and are reported to be more dependable, economical and offer greater functional efficiency than tanks of other materials. The tanks are highly resistant to most chemicals, oils and all major corrosive elements found in sea or air, and are unaffected by rust or electrolytic action.

■ The Aircraft Industries Association recently offered some figures to illustrate how expensive it is to equip the military with the latest jet fighters, bombers, etc. Reporting that Air Force officials were reluctant to discuss the cost of individual aircraft, the AIA did say that the Air Force reported that the latest heavy jet bomber costs, in round figures, about $7,500,000; and that the average production fighter costs about $793,000. The Air Force also stated that some jet engines cost about $250,000 each in quantity production; and that the electronic bombing systems used on intercontinental bombers cost from $200,000 to as much as $500,000 each. The aircraft industry's net profit as a percent of sales last year was only 3.8%.

cargo: one engineer and slide rule





AERO COMMANDER

Mr. M. is on his way to solve a difficult production problem at a plant 700 miles from his home office. His company plane will get him there fast, comfortably and free of restricting schedules.

He'll set down at one of over 600 Esso Dealer Airports, where he can let the Esso Aviation Dealer take over. By showing his Esso Aviation Credit Card and identifying himself, Mr. M. can charge high quality Esso Aviation fuels and lubricants, tire and battery service, landing fees, overnight storage, and minor emergency repairs.

Mr. M., like thousands of other business flyers, has learned to rely more and more on famous Esso Aviation Products — used by the world's largest airlines and backed by over 45 years of flight testing and research.

Esso

AVIATION PRODUCTS

now hear this . . .

PERSONNEL

Dr. Charles L. Critchfield recently was appointed director of scientific research for Convair Division of General Dynamics Corporation.

Maurice A. Barbettini has joined Southwest Airmotive, Dallas, as distributor-sales representative.

R. James Pfeiffer has been appointed executive director of customer relations for Fairchild Engine & Airplane Corporation.

William K. Lawton was appointed advertising manager and public relations director for L. B. Smith Aircraft Corporation.

Harvard C. Waken has been made controller of Pastushin Aviation Corporation. **Howard C. Powell** was named senior buyer.

Wendell E. Eldred was appointed engineering manager for landing gear products at Bendix Products Division of Bendix Aviation Corporation.

Robert S. Kinsey was elected vice president of operations for Reaction Motors, Inc. **Robert R. Lent** was named Washington representative for RMI. He succeeds **William M. Davidson** who recently was named assistant manager, customer relations and contracts division of RMI.

James L. Straight has joined Lear, Inc., as a member of the public relations staff.

Walter B. Voisard has been made sales and service manager of McCauley Industrial Corporation. He formerly was a project and field engineer for McCauley.

C. L. Foley has been named Fram Corporation representative in the Eastern area.

Kenneth Hatfield was appointed supervisor of quality control at Aerodex, Inc. **Walcott O. Kinder** was named superintendent of the Aerodex accessory overhaul.

Paul W. Kayser has been elected vice president-personnel of American Airlines.

Leonard K. Schwartz was appointed corporate director of commercial aircraft sales of Lockheed Aircraft Corporation.

Virgil J. Wiltse recently was named director of personnel at Piasecki Helicopter.

Robert Lovell has been appointed manager of aircraft sales for Townsend Company.

Jack Schopenhauer was appointed vice president in charge of maintenance of Riddle Airlines.

HONORS

Igor I. Sikorsky, engineering manager of Sikorsky Aircraft, received the 1955 James Watt International Medal awarded by the IME.

Dr. Kenneth E. Dowd, chief medical officer of Trans-Canada Air Lines, was elected president of the Aero Medical Association. **General Otis O. Benson, Jr.,** retiring president, was presented the Association's Theodore C. Lyster Award.

COMPANIES

Aeroquip Corporation has announced the acquisition of Marman Products, Inc.

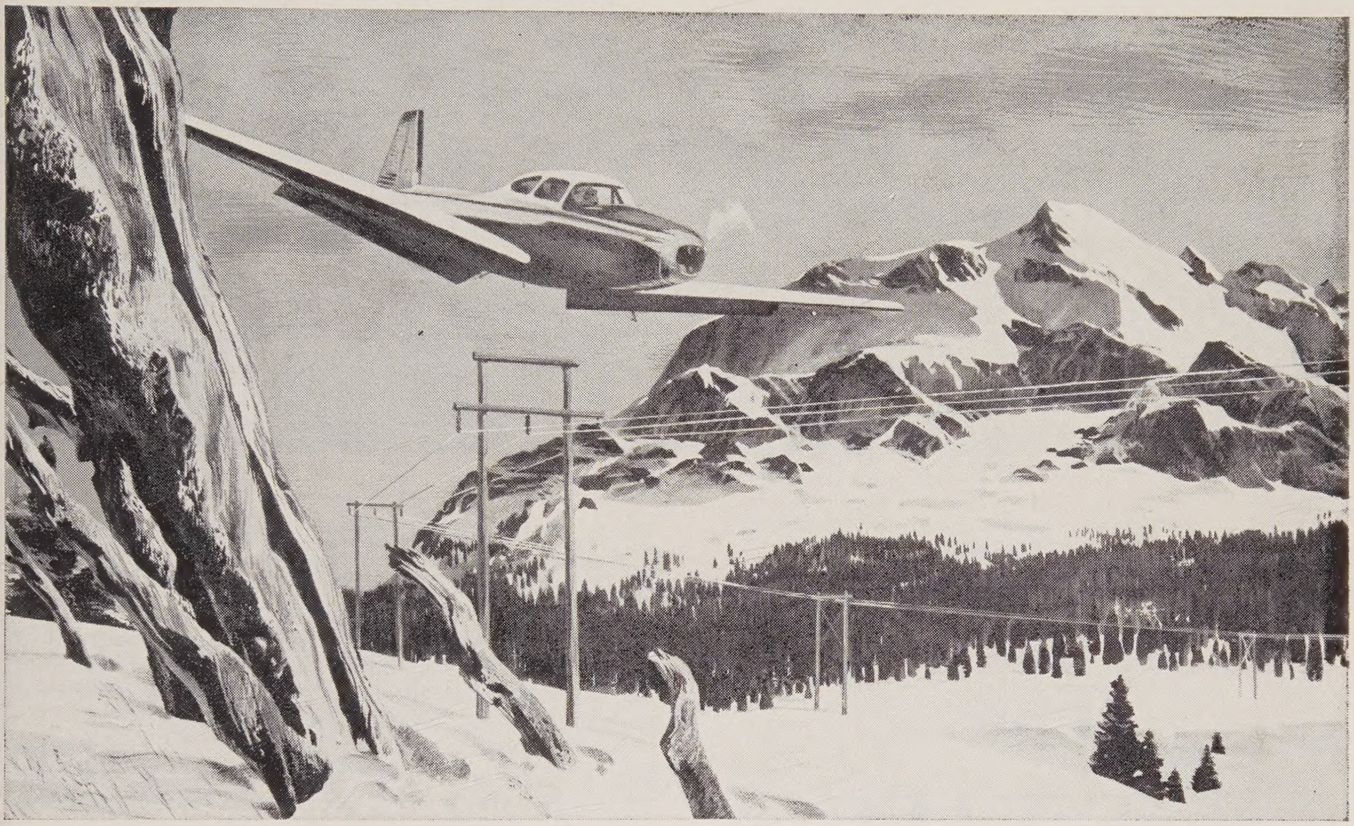
General Dynamics Corporation has given three grants to Massachusetts Insti-

(*Continued on page* 40)

PLANE FAX

Your Best Week-end Flight Plan for June

Fly to the Golden Rose Ski Festival at Mount Hood, June 12, the last tournament of the season. Plan to land at nearby Hood River Airport, Oregon, for quality Standard Aviation Products and service.



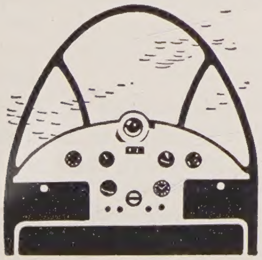
Riding power lines over Idaho mountains

A month's work in an afternoon! Flying at power-line level, over mountains and through valleys, Glenn Higby patrols 375 miles of line in 5 hours. He skims over broken terrain that used to take weeks to cover by trucks and on foot—but he's back the same day at his home port, Bradley Field near Boise.

"I keep the flaps one-quarter down for stability," he says, "and hold the prop in full low pitch. After that there's no trick to following the ground contour, as long as we have plenty of power in reserve. I always use Chevron Aviation Gasoline 80/87, because it gives me all the extra power I need, every time I need it. It ends plug fouling too—it's the most dependable fuel I've ever used.

"You'd think this kind of low-speed, high-power flying would be tough on engines, but we've had no trouble in the three years we've used RPM Aviation Oil. It cured the trouble we'd had with pre-ignition, and it gives us at least 200 extra flying hours between overhauls. 'RPM' really keeps rings and valves clean, right up to overhaul time. We never use anything else, in any of our planes."

T. M'S "RPM," "CHEVRON," "PLANE FAX," REG. U. S. PAT. OFF.



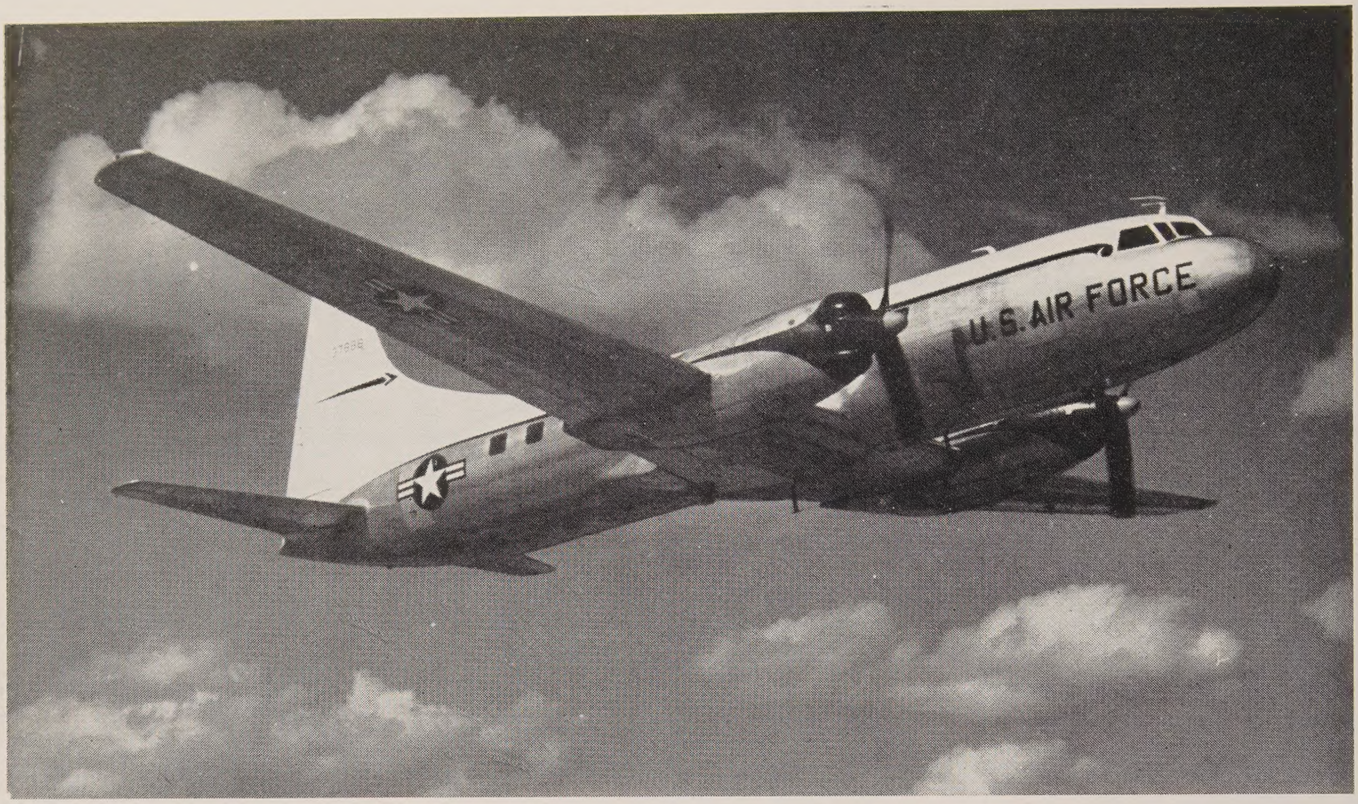
TIP OF THE MONTH

If there's a chance of flying into weather, it's wise to refer to your instruments often. Then it's easy to shift over to instruments in a hurry.

CHEVRON AVIATION GASOLINE

RPM AVIATION OIL

STANDARD OIL COMPANY OF CALIFORNIA



Engineering Report:

The CONVAIR YC-131C

by B. J. Simons
Project Engineer—San Diego

and

P. J. Lynch
Project Engineer—Ft. Worth

In an effort to accelerate the development of turboprop engines, the USAF some time ago contracted with Convair to convert two standard airline Convair-liners into flying test beds for Allison YT-56-A-3 engines. The basic premise upon which this contract was based was speed of accomplishment at minimum cost. It was stipulated that only those changes absolutely necessary be made to the standard airplane to effect this modification.

In the interest of economy, since the airplane was defined as a test bed, no anti-icing equipment was incorporated. However, proposals have been offered to install this equipment at any time the customer desires.

All portions of the airframe and airplane systems not directly affected by modifications remained in the CAA-approved commercial configuration, and both airplanes were certificated by the CAA prior to modification and had been flown within the gross weight limits established by the CAA for the standard airline version.

The service proven characteristics of Convair's Model 340 airframe and equipment made it an ideal vehicle for testing this new type Air Force engine for several reasons: *1*) The flight characteristics and performance of the basic airplane had been demonstrated and were accurately known; *2*) The maintenance difficulties of the basic airframe and systems were at a minimum; *3*) Pilot check-out and similar instructions were minimized in light of the Air Force's experience with the T-29 and C-131 type aircraft; and *4*) Logistics support of the airplane was benefited by existing T-29 and C-131 operators and trained maintenance crews.

Powerplant

The YC-131C powerplant consists of two Allison YT-56-A-3 turboprop engines, each consisting of a gas-turbine power section connected by an extension shaft supporting structure to a reduction-gear assembly and propeller shaft. The power section is made up of a multi-stage axial-flow compressor, six through-flow combustion chambers and a multi-stage turbine directly connected to the compressor. The 14-stage axial-flow compressor is driven directly by

the turbine and supplies compressed air to the combustion chambers. The compressor air-inlet housing encloses a set of guide vanes to direct air to the compressor blades, and also supports the accessory-drive housing.

The combustion-chamber assembly is composed of six combustion liners enclosed by an inner and outer casing. Air from the compressor enters the liners where fuel is introduced and the mixture is burned. Some of the air from the outer casing is directed against the turbine wheel to act as thrust balance and turbine rim cooling air. Engine-mounted accessories are cooled by air that is bled from the oil-cooler air scoop and exhausted through vents in the aft end of the upper cowl.

The four-stage turbine is driven by expanding gases from the combustion liners and is directly connected to the compressor and the reduction gear, thus furnishing power for compressing more air and for driving the propeller.

The engine is equipped with a condenser-discharge, high-voltage, high-energy ignition system. When engine speed reaches approximately 12% rpm, ignition begins and when the speed reaches approximately 58%, ignition is stopped. Burning is continuous beyond this point so ignition is no longer necessary. Igniter plugs are furnished only on the two lower combustion liners; flame propagation to the other liners is automatic. The engine starter is located on the aft face of the propeller-drive gear box. An external air source is used to start the first engine and bleed air from the first engine is then used to start the second engine.

The engine contains an anti-icing system controlled by the pilot. Compressor discharge air is used to anti-ice the compressor inlet guide vanes and struts, the compressor inlet-pressure probe, the fuel control thermostat probe and the extension-shaft shroud.

Each engine is equipped with a three-blade, full-feathering, reversible-pitch Aero Products Model A6341FN-198 propeller. This propeller was specifically designed for operation on the YT-56 engine, and is electro-hydraulically controlled. It can be operated either as a controllable-pitch propeller for engine starting and taxiing operations or as a constant-speed governing unit for flight operations. The hydraulic control provides for constant speed control while in the flight range, and also provides for a selective blade angle while in the taxiing range, which is below flight idle.

The electronic governor is used to improve speed stability by sensing turbine acceleration and scheduling blade-angle changes that are proportional to the rate of turbine-speed change. The propeller-control lever is interconnected through the engine-control system and linkage is to a single power-control lever in the cockpit. Movement of the power-control lever controls engine fuel flow and selection of power-operating range for the different operating conditions. When the power-control lever is at any position below flight idle, the propeller is operated as a controllable-pitch prop, with each position of the control lever representing a specific blade angle. The propeller does not govern in this range but does have over-speed protection. When the power lever is above flight idle, the propeller is in the governing range and will oppose any powerplant speed change with a blade-angle change to maintain a steady state.

Mechanical feather is accomplished by setting the cockpit condition lever at "Feather" position. This causes a signal to be transmitted by means of a series of linkages to the condition lever at the co-ordinator. The condition lever, when placed in the aft or "Feather" position, overrides the power lever through a discriminator mechanism in the engine co-ordinator to actuate the propeller linkage and accomplish mechanical feathering. When placed in the "stop" position, it also lifts the take-off stop in the propeller regulators and actuates a linkage on the fuel control to cut off the fuel mechanically. When the condition lever is in the "run" position, the take-off stop prevents inadvertent feathering of the propeller.

A prop will automatically feather when the engine speed drops below 13,000 rpm if the auto-feather system has been armed by the pilot and the power lever is above a ⅔-open position. The remaining propeller cannot feather automatically due to the action of an interlock relay. This automatic feathering operation is similar to the service-proven system on Convair Model 240, 340, T-29 and C-131 airplanes. The only basic difference is the actual trouble-sensing unit. Since this engine does not incorporate a torque-nose similar to the R-2800 reciprocating engine, another source for engine failure indication had to be found. There were already installed on the YT-56 engines speed-sensitive switches which controlled turning on fuel and ignition, turning off ignition and shutting off compressor bleed at pre-set engine speeds. It was then a logical choice to select this switch as a source of signal to the auto-feather system when engine speed fell below a certain value since this is a constant-speed engine.

Oil & Fuel Systems

The engine oil system consists of two complete and separate dry sump systems, one for each engine. In each, system oil is supplied from the tank to an engine-driven pump on the power section and a gear-driven pump in the reduction gear box. Scavenge pumps in the engine and reduction gear box return oil to the oil tanks. Oil coolers are provided for cooling the return oil.

The fuel system is composed of two complete systems, one for each engine, which are interconnected by means of a cross-feed system that provides for operation of either or both engines from either fuel tank.

Engine-driven fuel pumps provide fuel, at boosted pres-

MODIFICATION *required increasing tail surfaces; span of horizontal stabilizer was upped 40 inches; height of fin, 12 inches*

ALLISON *turboprop engines on YC-131C are equipped with three-blade, full-feathering, reversible-pitch Aero Products propellers*

sure, to the fuel-control unit. The engine drive fuel-pump assembly is made up of a single centrifugal boost element and two gear pumps, a primary and a secondary unit. Provisions are installed to give indication to the pilot should the primary pump fail. Either pump is capable of satisfying system requirements.

Electric-driven fuel booster pumps also are installed in each tank system, and these provide fuel at boosted pressure for engine starting, and high-altitude operation.

Initial regulation of fuel flow is made through the co-ordinator which transmits information of power-lever position changes to the fuel-control unit. These signals are co-ordinated with propeller and electronic temperature datum controls. Fuel flow is further corrected by the electronic temperature datum control which senses differences between the actual and desired turbine-inlet temperature at various power-lever settings and corrects the fuel flow accordingly. The electronic temperature datum control also furnishes over-temperature protection by limiting fuel flow when the turbine inlet temperature reaches the maximum allowable.

The fuel required is JP-4 and the lubricating oil is ESSO Aviation Turbo 35, a synthetic oil.

When we investigated the characteristics of the original 340 fuel system, we found that very few changes were required for the JP-4 fuel, the higher operating altitude and increased power of the airplane. The integral wing tanks holding a total of 1,730 gals contained primary and secondary sealants which were well suited to JP-4. The line-mounted, positive-displacement-type fuel booster pump was of adequate pressure and volumetric capacity.

Some line re-routing was necessary, of course, and a few minor components containing resilient seals had to be changed.

The oil system design, however, was entirely new. This turboprop engine uses a synthetic-type lubricating oil which required special-type gasket compounds and flexible hose assemblies. Considerable laboratory testing of materials was undertaken to assure resistance to this relatively new liquid.

The oil tank itself and most of the lines and fittings were made of stainless steel. Tank capacity of 7 gals liquid volume was based on AF rules for airplane duration and reserve quantities. Previous laboratory tests had shown that the synthetic oils were not susceptible to foaming at altitude, consequently no elaborate deareation precautions were incorporated in the system. Expansion space above the oil is approximately 25% of tank volume.

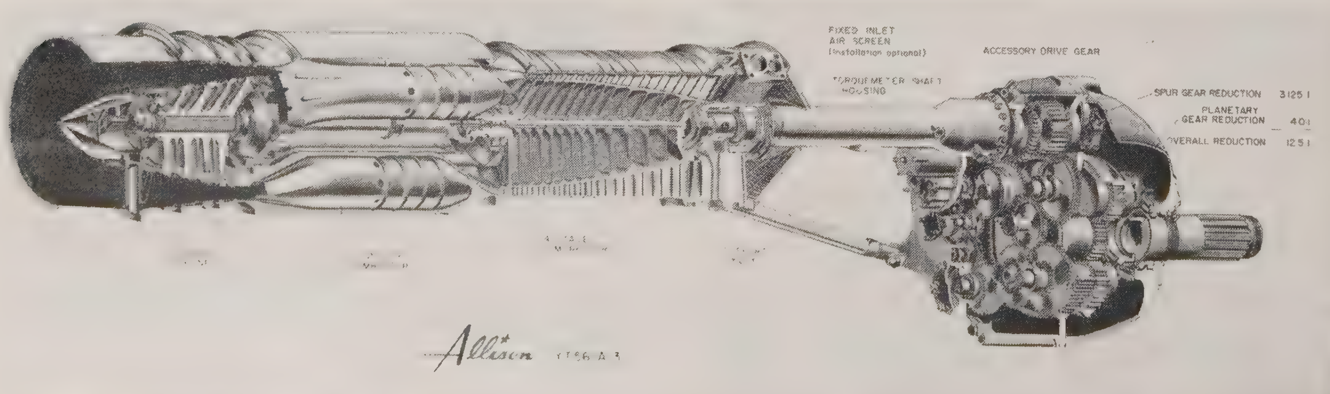
Installation & Modification

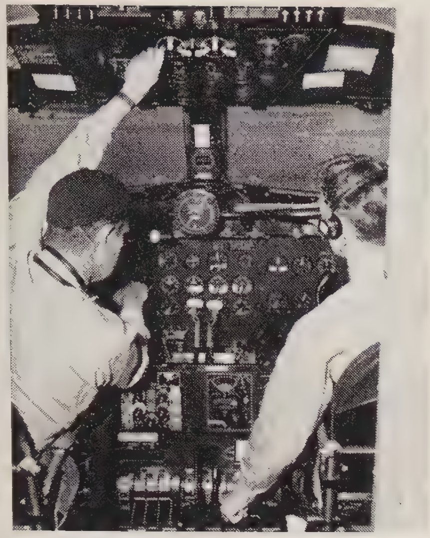
To install these turboprop engines it was necessary to remove the original nacelles from the basic 340 with the exception of that part forming the landing-gear enclosure. A new semi-monocoque nacelle was designed to support the engine and to house the accessories. Two engine-mount points were provided at the forward end. These mounts consisted of bushing-type rubber vibration isolators and were designed to take thrust, vertical and side load. The aft mount point, also a rubber type, was located on the lower engine centerline and designed for vertical and side load only. A double link arrangement was provided at the aft mount to accommodate approximately ¼-inch of engine thermal expansion.

Large hinged access panels were installed in the top of the nacelle for access to the aft section of the engine, and a single large door in the lower nacelle forward of the wing.

A vertical firewall of stainless steel was used to isolate the compressor section of the engine from the burner section. This firewall continued on to the bottom of the nacelle to isolate the wheel-well section from the compressor section. (*Continued on page* 36)

CUTAWAY *of Allison YT-56-A-3 turboprop engine details power section connected by extension shaft to reduction gear and prop shaft*





COCKPIT *coordination is essential to good operations. The periodic checks are the watchdogs of efficient pilot procedures*

The Hood and Enroute Checks

Increase in air traffic makes establishment of standard business-plane procedures necessary

by Harry R. Van Liew

Capt., United Air Lines
Pres., Executive Air Transport Co.

In any of the arts, proficiency is the result of practice, and the art of flying safely and proficiently is no exception. While practice should make perfection, it can lead to imperfection in that familiarity with a task sometimes breeds carelessness in the accomplishment of that task. This fact was recognized by the airlines only a comparatively few years ago—1937, to be exact. Prior to that date the requirement on the pilot was small. In the years 1935 to 1937, there were only a few airlines—United, TWA and American flying from coast to coast and all covering different routes; Eastern Air Lines flying the east coast; Northwest Air Lines covering the Chicago area and the northwest; and Braniff, Mid-Continent, Continental, and Western Air covering the central part of the U.S.

During this same period, there was no military instrument flying. Cancellation of the airmail contract and the military's being called upon to "deliver the mail" had proved the military did not know how to fly "on the gauges.

Other factors important in the consideration of this period were the number of aircraft being operated, their hours of utilization, and the navigation facilities then existent. United was operating 60 Boeing 247's, at that time the most modern of aircraft, whereas other airlines were using the Fords, the Stinsons and the Curtiss *Condors*. In all, there were about 200 air transports flying the airways, each from four to seven hours a day. The only navigation aid was the LF range which set the pattern of the airways. On the route Newark to Cleveland, for example, the airline pilot had Newark, Allentown, the N leg of Harrisburg, Belfonte, Mercer, Akron and Cleveland. Multiply those stations by four and you have a typical airways in 1935. Add to this the fact that there was no itinerate instrument flying and there were no emergency procedures as such, and you can see why life to the pilot, the operator and ATC was comparatively simple.

In 1937, however, Douglas Aircraft brought out its popular DC-3 which offered single-engine performance. More aircraft began flying the few approved airways; the airlines began expanding their operation; aircraft utilization went up and radio aids to navigation began to appear, all of which brought about a need for uniformity in emergency procedures and the control of air traffic as well as a need for new methods of navigation via radio. Also, new airlines were formed—Capital (then Pennsylvania Central), C and S, and Delta, to mention a few, and the military began flying at night and on instruments.

When a series of costly accidents and near-accidents beset the air-transport industry, the CAA, the insurance companies and the airline operators themselves quickly got together to study the situation and find a solution to the problem. Soon it was discovered that there were as many different operating procedures in any one airline

(Continued on page 28)

FLIGHT PLAN *is worked out by United Air Lines' Captains Van Liew (left) and Larson. Today, all airline and military pilots are performing certain operations in like manner*

Sealing of Integral Fuel Tanks

by Willis L. Nye

On those air transports that make use of a fuel system that draws from an integral fuel tank, a large portion of the cost of airframe overhaul at the periodic may be involved in the repair of these fuel tanks. These tanks are integral cells of the wing structure and are coated with a rubbery material to provide a liquid-tight seal for the fuel. After extensive use, the material tends to deteriorate, may blister, flake or fail to adhere to the structure. Consequently, stripping and replacement of the material usually is mandatory.

Prior to awarding a contract to a facility for major airframe overhaul, it is advisable to determine what method of integral fuel tank sealing the facility employs as well as what kind of materials they use. There are several types of fuel-tank sealants available on the market and there are several methods of application of these materials. However, the fill-and-drain method of tank sealing has much to recommend it and is the method used at most of the major overhaul centers. This method of tank sealing requires adequate equipment, such as pumps, tanks, curing heaters, etc.

Inspection: The integral fuel tanks are inspected at least once every 1,000 hours. In order to check the interior of the tanks, the inspection access plates must be removed, thus making it possible to visually inspect the condition and adhesion of the sealant, and to check on evidences of internal leaks or structural damage to the wing interior.

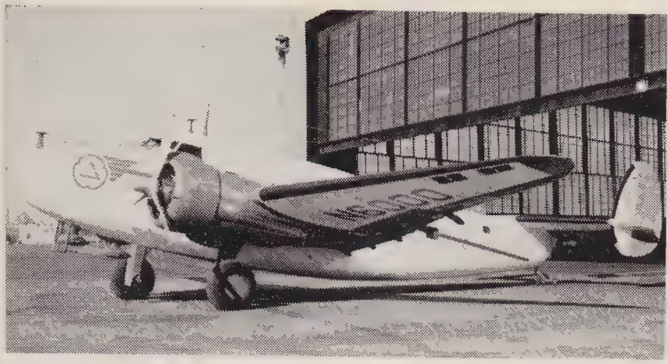
The fuel tanks should be filled to the top, sealed at the filler neckcap, then inspected for the presence of external leaks. These may be centered around the inspection access plates or along the wing spars. The performing inspector notes the kind, the color, and the size of the areas where a leak occurs, on a fuel-tank leak chart which is actually an outline of a wing showing the areas where the tanks are installed. If the exterior leaks are beyond normal repair during overhaul, the tanks are noted as requiring complete resealing with new sealant.

If an external inspection indicates only normal leaks are present and that sealing repairs can be made during overhaul, the inspection access plates are removed and the interior of the tanks checked to determine where the leaks are coming from. Particular note is made of the adhesive qualities of the sealant to the wing structure. If the sealant is pulled away or stretched, although the tank may not be leaking, it is not suitable for further use and should be resealed.

However, when a fuel tank is repairable, the condition of the sealant should be repeatedly checked in the leak area so that internal leaks will not develop after the sealing repairs have been completed and the access plate reinstalled. An item of importance in tank repairs is the cleaning of the inspection access plates. *New* material should be applied before access plate re-installation. Usually, the inspection access plates of the integral fuel tanks at the rear spar are not installed until the sealant of the tanks has dried and the job has been formally approved by inspection personnel. To be certain no leak reoccurs in this area, these plates oftentimes are not installed until the airplane is ready for the flight line. After the initial test flight after overhaul, the faying surfaces of the wing skin and

INTEGRAL TANK *resealing job on a twin Beech, such as this one owned by Universal Moulded Products, may cost from $750 to $900.*

Prior to awarding major airframe overhaul contract to a facility, it is good idea to determine facility's method of tank resealing



RESEALING *tanks of Lodestar, depending on model and the fuel-tank system, can run as high as $8,000. An analysis of various tank-resealing operations enables customer to get some idea of cost*

FUEL TANKS *of this Douglas DC-4 are being hand-stripped by the Lockheed Aircraft Service men at Lockheed's Burbank operation. This stripping removes all traces of the old and worn sealant*

the inspection access plates should be checked again for the presence of fuel leaks.

Fuel-Tank Sealant: As previously stated, there are several integral fuel-tank sealants on the market, and all of these materials must meet the airworthiness requirements. To name a few, TC-46, Proseal, EC-801, and Product Research materials, all offer certain well-defined advantages to the customer who uses them. Some of these materials dry more quickly than others. Some cost less than competitive products and some may be installed more quickly or are more easily applied than others. But all of these materials do the function required of them and are sufficiently elastic to maintain a sealed joint at the faying surfaces when the wing is flexed under conditions of load.

Stripping: When the sealant on an integral fuel tank has deteriorated, the material must be removed in order to reseal the tank compartments. The fuel tank is completely drained of fuel after the preliminary inspection has been made. The inspection access plates are reinstalled and the tanks are filled with a stripping solution containing chemicals that will dissolve the tank sealant. Usually a dwell period of 24 hours is necessary to completely remove the adhesive tank sealants. In some instances more than two fill-and-drain operations may be necessary to completely remove the tank sealant. Under normal conditions, however, this fill-and-drain operation is performed just twice, and then the tank is ready for cleaning by high-pressure steam containing a detergent in solution. After washing, the tanks are hand cleaned, the interiors sprayed with ethyl acetate, and steel parts, such as fittings, are coated with a protective chemical to prevent corrosion.

Necessary Equipment: If the cost is to be kept within reasonable amounts, it is not possible to seal a fuel tank unless adequate equipment is available. At least two 2500-gallon tanks should be available, as well as a high-capacity fluid centrifugal-type pump with a flameproof motor, necessary piping and supply lines, standpipes for fuel tanks, a car washer, sealant injection tools, spare inspection access plates for quick reinstallation or removal, plus the necessary chemicals. Provision should be made for rejuvenating the stripping materials after each use because 10% of the chemical effectiveness is lost after each fill-and-drain operation.

Sequence of Operation: It is often advantageous for the business-plane owner to have some idea of what is involved in a tank-sealing operation so that he may appraise the cost of the job. Depending on the tank sealant used, the following is a general outline of the operation:

1. Prepare and Strip Tanks

   a. Cap fuel and vent lines and seal fuel-supply lines.

   b. Remove all liquidometers and fuel-tank pump assemblies.

   c. Close the tanks and fill with stripper.

   d. Drain the stripper after a dwell of 24 hours.

   e. Fill with stripper.

   f. Drain the stripper after a dwell of 24 hours.

   g. Wash the interior of the tanks with high-pressure steam and water with detergent in solution.

   h. Hand clean the interior of the tanks.

   i. Coat the interior tank surfaces with ethyl acetate.

2. Structural Repair and Modification

   a. Coat steel parts with an anti-corrosive material.

   b. Inspect the interior of the tank compartments for structural damage.

   c. Repair structural members where necessary.

   d. Replace or tighten loose bolts and rivets.

   e. Inject sealing material into all joints, faying surfaces, cavities, gaskets, angles, etc.

3. Sealing Operation

   a. The entire interior of the fuel tanks is covered with a brush coat of tank sealant.

   b. Allow the sealant to dry or cure either by natural or artificial heat.

   c. Apply the second coating of tank sealant.

   d. Allow the second coat of sealant to dry.

   e. Apply two spray coatings of sealant to interior of the tank. Allow 8 hours drying time between spray coatings.

   f. Perform inspection to ascertain any areas where blisters may prevail or when leaks may occur. Apply coating by brush over these areas, and allow to dry.

   g. In the same manner apply sealant to inspection.

(*Continued on page* 40)

TANKS *thoroughly cleaned by high-pressure steam containing a detergent, the tank sealer sprays the interior with ethyl acetate*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

JUNE 1955 *Wings Club, New York*

Safety Aspects of Flight Test Operations

Test pilots' discussion discloses dire need for improvement in survival gear, plus a means of exchanging information on test pilots' mutual safety problems

Moderator Jerry Lederer (*Director, Flight Safety Foundation*): "Of prime interest to all of us in aviation is this matter of safety—safety in operation, whether it be airline, business plane, the military or, as in this particular instance, test flying. Before coming to this meeting, I jotted down a few items for discussion in the hope they would help guide the conversation. One is, the problems of the immediate future as seen by the test pilot; another, is there a sufficient exchange of information between the test pilots of the various companies so that full advantage can be taken of each other's experiences. Perhaps other points will evolve as the discussion progresses.

"*Beginning with the problems of the near future, what in the opinion of test pilots needs thought and attention right now? Before this meeting got underway, Tex Johnston mentioned the problem of ventilation. Tex, would you elaborate on that?*"

A. M. "Tex" Johnston (*Chief of Flight Test, Boeing Airplane Co.*): "From the standpoint of test operations, both now and for the future, there is great need for improvement in personnel equipment. The majority of the development work today on high-performance aircraft is at 45,000 feet, and those who fly aircraft at that altitude and above must be protected at least by pressure suits in the event of depressurization.

"I don't know whether or not any of you gentlemen have had any experience with pressure suits, but they are very uncomfortable and they restrict the pilot's ability to use his hands and feet to such an extent that it actually makes it difficult to manipulate the controls of the airplane, particularly in large aircraft where many of the switches and the various controls are located in areas requiring radical movement of the arms so that they can be reached.

"Both the Air Force and the Navy are doing a con-

ROUND TABLE PARTICIPANTS

Moderator

JEROME LEDERER, Director of Flight Safety Foundation was chief engineer for Aero Insurance Underwriters from 1929-48 when he organized FSF.

L. L. BRABHAM, vice president of Republic Aviation since 1952, is a veteran test pilot. He joined Republic in 1940; was closely associated with testing of P-47, F-84.

FRED S. CHAMBERLIN, chief engineering pilot for Wright Aeronautical, has been flying since 1932. He has been a test pilot for Wright Aeronautical Div. for 15 years.

GEORGE WIES, sales engineer for Sperry, joined that organization in 1941 after two years as business pilot for Robt. Lehman; is also former N. Y. News pilot.

WILLIAM BEDELL, test pilot for Grumman, is a former Navy pilot. He is a graduate of the Navy's Test Pilot Training School at the Naval Air Test Center.

HERBERT O. FISHER spent 14 years as an engineering test pilot for Curtiss-Wright before becoming Chief, Aviation Development for the New York Port of Authority.

DUKE KRANTZ, chief pilot for Bendix Aviation, was for many years a pilot for N.Y. Daily News. During the war, he was chief test pilot for Bell Aircraft at Marietta, Ga.

E. M. BEATTIE, chief pilot for General Electric, joined G.E. in '53 after flying as American Airlines captain for 12 years; was also pilot for Gannett Newspapers.

A. M. "TEX" JOHNSTON, chief of flight test for Boeing, was B-52 project pilot until his appointment as chief of flight test in 1953; has logged some 12,500 hours.

SAFETY ASPECTS *of flight test operations were discussed at Round Table by (left to right) L. L. Brabham, vice president, Republic; E. M. Beattie, Chief Pilot, General Electric; Fred Chamberlin, Chief Engineering Pilot, Wright Aeronautical; William Bedell, Engineering Test Pilot, Grumman Aircraft; Jerry Lederer, Director of Flight Safety Foundation, who served as Moderator of the meeting; A. M. "Tex" Johnston, Chief, Flight Test, Boeing; Duke Krantz, Chief Pilot, Bendix Aviation; George Wies, Sales Manager, Sperry; C. G. Talbot, Manager of Flight Test Center, General Electric, who served as an observer; and Herb Fisher, Chief Aviation Development, Port of New York Authority, and former Curtiss-Wright Corp. test pilot*

siderable amount of work in trying to improve these pressure suits, but even the best we have today leaves much to be desired.

"I think we ought to do all we can toward improving that type of equipment. As we move along into higher altitudes, it is even more essential. Anyone who goes over 45,000 feet without that equipment doesn't have a chance."

L. L. Brabham (*Vice President, Republic Aviation Corp.*)*:* "Escape possibilities must be emphasized. For example, the automatic opening of parachutes, etc. We must give the pilot means of escape. At Mach 1.5 the pressure that would be exerted on a pilot's diaphragm could collapse his lungs."

Duke Krantz (*Chief Pilot, Bendix Aviation*)*:* "How about survival with regard to oxygen? Survival would be impossible without the proper supply of oxygen. Temperature also is a factor."

L. L. Brabham: "They all go together. If you bail out at 45 or 50,000 feet, you have no more than about 15 seconds of survival. We must have protection."

Tex Johnston: "When you are taking an airplane to the higher altitudes, you must wear protective clothing in order to protect your anatomy from bruises, pinches, etc., if the suit inflates. First, you put on long-john underwear, then you put on your pressure suit. After that comes a heavyweight winter flying suit as the temperatures are 50° or below. With all that gear on, you then strap on 45 pounds of parachute and other survival equipment. If there is a lot of water in the area, you wear a Mae West.

"With all that on, you climb into the cockpit and start your cockpit check. On a large airplane the minimum time for a cockpit check, a radio check and an instrumentation check is about 45 minutes; sometimes it's more than that. And even under normal temperature conditions, say 75°, by the end of that check-time your clothing and underclothing are completely saturated with perspiration. Then you take off and climb to the aforementioned high altitudes.

"Assuming you are operating at subsonic speeds, the ejection seat will get you clear of the airplane, but it is a question of whether or not it does you any good to get out inasmuch as you are so moist and are exposed to such low temperatures that it probably would be fatal even if you had sufficient oxygen, etc. You carry oxygen with you in bottles for the pressure suit, and in case of a decompression accident there is 10 minutes of oxygen available if you haven't already lost it. But that's another problem.

"If you are flying aircraft in excess of subsonic speeds, at supersonic velocities in the numbers we're thinking of today, the ejection seat is not the answer. Designers are going to have to start thinking in terms of separating the pilot's compartment itself from the airplane in the event you have to abandon ship.

"As I see it, it is necessary to separate the pilot's compartment so that he can ride that down to somewhere below 35,000 feet (actually, he has to go down to about 20,000 feet); then the pilot needs automatic equipment to open the compartment, automatic equipment to get him out of the compartment, automatic equipment to separate him from the seat and then automatically open his parachute. The separated compartment itself is going to have to have some sort of stabilizing device or a stabilization chute. If it doesn't, the instability of that type of structure will result in severe nausea and it would be a question of whether a pilot loses all his faculties.

"That is what we are faced with, with the type of equipment we're thinking about today."

Jerry Lederer: *"Can you tell us, Tex, what Boeing is doing with respect to this problem of, shall we call it 'pilot well-being'?"*

Tex Johnston: "To combat this condition as best we can with the equipment available today, we have purchased and do operate air-conditioning equipment in the airplanes on the ground so the cockpit is cool when the pilot arrives. This air-conditioning continues to operate during the cockpit check-out. Then you fire up the engines, letting the ground air-conditioning run as long as you can. Then you disconnect it and when you get your power, you start the ship's own air-conditioning system."

E. M. Beattie (*Chief Pilot, General Electric Co.*)*:* "We at the G.E. Flight Test Center have limited all of our

(*Continued on next page*)

flights to 45,000 feet because of the lack of survival gear. I don't think these pressure suits are the answer because of the limited movement they permit."

Duke Krantz: "Tex, do you anticipate explosive decompression at any time, and have you had them?"

Tex Johnston: "We have never experienced explosive decompression in our equipment at Boeing."

L. L. Brabham: "I have known of several cases of explosive decompression. In almost all cases in an airplane the size of the Boeing, if you get explosive decompression, you lose your helmet, your oxygen mask, in fact just about everything blows off and you have to go like hell for lower altitudes. You have to if you're going to live. If you're flying a jet bomber on a military mission, perhaps over enemy territory, and you blow a hatch and have to head for lower altitudes, you aren't going to get home. You'll either be shot down or you'll be burning fuel so fast you won't be able to make it back to base."

Jerry Lederer: *"Capt. Beattie had an actual case of explosive decompression. Would you describe it?"*

E. M. Beattie: "We climbed to 35,000 feet pressurized to 6.55 psi, and had only been leveled off for a short time when the canopy failed. The canopy was a bubble type of clear plastic with reinforced strips of Fiberglas running longitudinally and transversely, thus appearing to form panels, each something over a foot square. Six of these panels around my head failed explosively. I prepared to descend immediately, but I can recall only that I nosed the airplane down and that I partially reduced engine power. I was conscious for not more than 10 seconds following the blast. Later it was found that the oxygen mask hose had parted from the supply line at the disconnect fitting, apparently due to the force of the blast. The regular blinker had functioned normally during the climb. For the next 10 or 12 minutes I remained unconscious, a victim of hypoxia, and during that time the copilot took over and made the descent. As you know, the B-45 has tandem seating.

"An interesting sidelight is that the pieces of canopy traveled almost straight outward to the side through the airstream about 10 feet and then through the skin and structure of the engine nacelle where they lodged against the engine compressor case.

"I began to regain consciousness at about 18,000 feet, but it was several minutes before I had anything like useful consciousness. During that period, I overpowered the copilot on the controls and put the airplane through some pretty violent maneuvers in a blind attempt to fly. The instruments in the airplane showed I'd made a 7 G pull-up. During all that, I must have been in the twilight of consciousness without use of any faculties, including sight, and I was laboring under the belief that the other crew members also were incapacitated. Useful consciousness returned slowly during the next 15 or 20 minutes, but it took several minutes before I could focus my eyes successfully on instruments or landmarks.

"I've been told that failure of the canopy was due to improper fitting just before the flight. No allowance had been made for the difference in coefficient of expansion between the aircraft structure and the plastic. The canopy had been pressed longitudinally beyond the breaking point by contraction of the fuselage in the cold air at altitude."

Tex Johnston: "Again it all goes back to survival gear. I know that our oxygen equipment and other things associated with survival are so far behind the airplane when it comes to development that it is simply ridiculous."

Jerry Lederer: *"Mr. Chamberlin, have you anything to add?"*

Fred S. Chamberlin (*Chief Engineering Pilot, Wright Aeronautical*): "When I was in England a few years ago, some of the English jet pilots were wearing what they call a pressure waistcoat—or a pressure vest, as we'd call it. I've never seen anything like it in this country. It seemed to have a lot of merit, particularly for the fighter pilots. These boys were using them at 50,000 feet and they said it stayed with you in case of decompression. You can get down pretty fast in a fighter, and I'm wondering why people in this country haven't done some work on a pressure vest."

Tex Johnston: "Did it have a helmet associated with it?"

Fred Chamberlin: "No, it's just a vest."

Tex Johnston: "If you're above 45,000 feet, all the oxygen in the world isn't going to help if your lungs are not pressurized, and you can only do that by use of the helmet. You have to pressurize your lungs and breathe straight oxygen. If the differential pressure is such that alveolar oxygen pressure is insufficient to permit the lungs to pick up the oxygen and transfer it to the bloodstream, you're out of business. It's strictly a question of pressure."

"PILOT *must be given a means of escape," emphasized L. L. Brabham (left). "At Mach 1.5 pressure exerted on the pilot's diaphragm would collapse his lungs." Seated to Mr. Brabham's left is E. M. Beattie, Chief Pilot of General Electric Company*

"GREAT NEED *in test flying today," stated Tex Johnston (left) "is for improvement in personnel equipment, particularly pressure suits." Seated next to Mr. Johnston are Duke Krantz of Bendix Aviation (center) and George Wies, Sales Engineer of Sperry*

Fred Chamberlin: "They put the pressure around your chest and they do have a pressure mask with it. They don't use the vest for any kind of an airplane that has to stay up high for any period. Actually, they figure they have 30 seconds to get down below 10,000 feet, and they are looking for an extra 20 seconds of survival time."

Tex Johnston: "That might satisfy the situation for a fighter because of the high rate of descent that airplane is capable of, but the problem is with the larger aircraft with their multiple crew members. The jet fighter isn't going to get over Moscow or over targets that are inland, so we're talking about the heavy bombardment-type aircraft. If you go to low altitudes with them, you won't get back, so you have to stay at high altitudes.

"Actually, there are two ways you can encounter this survival problem. One is through structural failure of the airplane, *i.e.* you lose a hatch or something like that. The other, and more probable, is battle damage which may result in a slow bleed of cabin pressurization. In either case, you have lost pressurization, so you have to have a pressure suit of some type so the man can continue to operate for five or six hours at that altitude. Otherwise you've lost the equipment as well as the crew, and you know how much money is tied up in training your crew to operate this type of equipment, plus the cost of the machine. It's a staggering amount."

William Bedell (*Engineering Test Pilot, Safety Advisor, Grumman Aircraft*): "We are very concerned about the lag that exists between the development and improvement of the pressure suit and the airplane. The safety belt also lags behind the airplane. Col. Stapp did a lot of work on the safety belt and his is a lot better than the one we now have. Why can't we get those things right away?"

L. L. Brabham: "We need improvement in the helmet, too."

George Wies (*Sales Engineer, Sperry Gyroscope*): "Not to change the subject, but it seems to me the jet transport will be here before too long, and I wonder how this survival business will apply to the passengers."

Jerry Lederer: *"Tex, can you answer that?"*

Tex Johnston: "It is contemplated that our jet transport will operate in the vicinity of 35,000 feet. With the design that we have incorporated in the airplane, the landing gear may be lowered and it is structurally capable of withstanding the air loads at the speeds you would be operating at these altitudes. In the case of an explosive decompression, by dropping the landing gear immediately and applying the air brakes, we can accomplish a rate of descent that is sufficient to get down in time to save the passengers. However, when we start operating at the altitudes to which we are expecting to go within the next several years, that will be entirely different."

E. M. Beattie: "We have engine development work that requires going to the altitude limits of the aircraft, and yet because of this survival gear business we have to keep ourselves at 45,000 feet or adopt pressure suits. I'd like to know what development work is being done toward improving this situation."

Tex Johnston: "The pressure suit is the only answer right now. I haven't been down to the Air Force's Aero-Medical Branch lately, but the last time I was there they recognized the problem and were working on it as rapidly as they could.

"As far as Boeing is concerned, if we stopped flight testing at 45,000 feet, we wouldn't be in the airplane business. Consequently, we're using the equipment that is available."

L. L. Brabham: "Frankly, the flying we are doing today is like darting across Fifth Avenue against the traffic!"

Tex Johnston: "All of our crews have been sent to the Air Force Indoctrination Facility for indoctrination in the use of pressure suits. It takes about three days to learn how to use them. The suit reverses your respiratory process. Normally, you use muscular exertion to inhale and you relax to exhale. With the pressure suit, you relax and it blows you up, and then it takes muscular exertion to exhale. A person's physical capabilities are such that you can only operate that way for about 10 minutes. That's the criteria they came up with to control the amount of oxygen that is supplied. It will vary with the individual, but 10 minutes is the mean average. I have experienced decompression from 25,000 to 60,000 feet in a chamber. Immediately the suit inflates, you start struggling to breathe. It's hard work but it's better than being dead. The pressure suit is uncomfortable and its restricts your mobility to perform your normal pilot duties when it isn't inflated. When it is inflated, you *really* have a problem."

E. M. Beattie: "That's my point. We are all dissatisfied with the oxygen mask because of the discomfort of it.

(*Continued on page 38*)

"ENGLISH *jet pilots," reported Fred Chamberlin (left), "wear pressure vests with a pressure mask . . . and they stay with you in case of decompression." William Bedell of Grumman Aircraft is seated next to Mr. Chamberlin, test pilot and safety advisor*

"ARRESTING GEAR *for airports," said Herb Fisher (right, next to Moderator Jerry Lederer), "could easily save an airplane that is over-shooting. The Port Authority engineers have visited several companies producing such devices over the past several months"*

SKYWAYS FOR BUSINESS

News Notes for Pilots, Plane Owners Operating Aircraft in the Interest of Business

Greenbrier Airport Offers "H" Facility for Approach

White Sulphur Springs, W. Va. Executive DC-3's, *Lodestars, Mallards,* A-26's and other aircraft which used to skim the ridges VFR to arrive at White Sulphur Springs, location of the famous Greenbrier Hotel and Cottages, now can approach on top or at IFR altitudes and make an approach via the "H" facility "SSU."

A radio beacon or "H" facility, with voice, is operated by the Greenbrier Airport for the safety and convenience of transient corporate, business, private and government aircraft coming into the field. The "Homer," with the identification "SSU" and on 406 kc, is limited to 75 watts by the FCC, but it provides ADF bearings 40 to 50 miles out and a CAA-approved let-down.

According to Charles O. Tate, Jr., president of the airport and former TWA pilot who operates the charter service at White Sulphur Springs, the "H" facility has resulted in more dependable operations, greater passenger comfort on rough days and increased safety.

In addition to the "Homer," Greenbrier Airport operates two-way VHF communications on 122.8 mc, and receives on 122.1, 122.5, and 3023.5, and other medium frequencies on request. Due to hilly terrain, good communications are often more reliable on 406 kc and 3023.5 kc. The CAA-approved minimums are 2100 ft and 2 miles, or 3900 ft msl, as compared with minimum enroute altitudes of 6,000 on airways.

Greenbrier Airport has a concrete 3500-ft runway designed for 100,000-lb aircraft. An extension of 1,000 or 1500 ft is contemplated.

CAA Study Shows Multi-Engine Business Planes Fly More Hours

Washington, D. C. A recent study prepared by the CAA and entitled, "Hours Flown in General Aviation by Aircraft Type and Location," indicates that multi-engine non-air-carrier aircraft fly almost three times as many hours annually as do large single-engine aircraft. Used primarily for executive transportation, the multi-engine aircraft averages 355 hours of use each year. This contrasts with 129 hours annually for four- and five-place single-engine aircraft, and 81 hours for the small two- and three-place aircraft.

This study is based on data obtained from Application for Airworthiness Certificate and Annual Inspection of Aircraft forms submitted by 13,797 aircraft owners. A limited number of copies of the study are available from the Office of Aviation Information, CAA, Washington 25, D.C.

Geometric Boundary Layer Control Adds 12 mph to Bonanza Cruising

Los Angeles, Calif. An extra 12 mph has been added to the cruising speed of the Beech *Bonanza* at 8.000 ft without increasing horsepower, according to an announcement by the AiResearch Aviation Service Division of The Garrett Corporation.

The extra 12 was accomplished following an experimental application of geometric boundary layer control to the wing leading edges of the *Bonanza* owned by Vance Breese, well-known aeronautical consulting engineer. The research was instituted to test a much-discussed theory that wing contours on commercial, mass-produced aircraft become geometrically imperfect during manufacture, that in their final form they are not true to the original contour visualized by the aerodynamic engineers. The resulting distortion in laminar flow of air over the wing and other surfaces causes excessive drag.

By smoothing off protruding rivets and applying microscopic layers of an especially developed surfacing material, AiResearch was able to build up the leading edges of the *Bonanza's* wing surfaces to remove the uneven hills and valleys which existed. At 12,000 feet, the *Bonanza* now cruises at 167 mph using only an 80% power output. Fuel is burned at a rate of 6.4 gallons per hour. An improvement in take-off performance also has been noted in Mr. Breese's plane, but the amount of improvement has not been accurately measured as yet. This is expected to be tested soon.

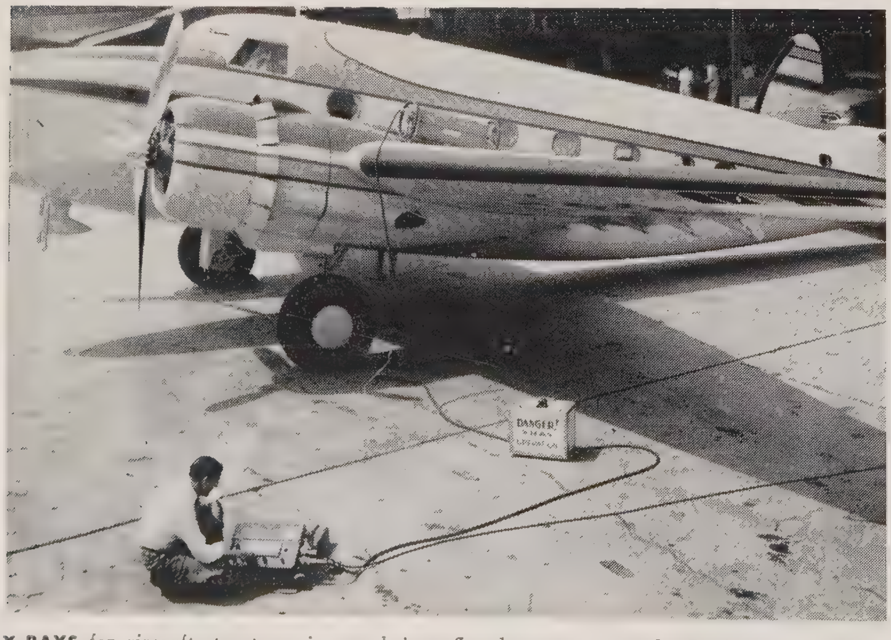
Air Service Inc. Expands to Offer Aircraft Conversion

Stratford, Conn. Air Service Incorporated, operators of an executive charter plane service and air cargo, recently announced their entry into the aircraft conversion field. Employing skilled personnel and precision equipment. Air Service Inc. reports it is equipped to handle any type of aircraft conversion, from design to final product. Exterior painting also is available from Air Service. A feature of the Stratford operation is the availability of men to do small custom jobs in the customer's own hangar, thus minimizing tie-up time. Air Service Incorporated is located at Bridgeport Municipal Airport, Conn.

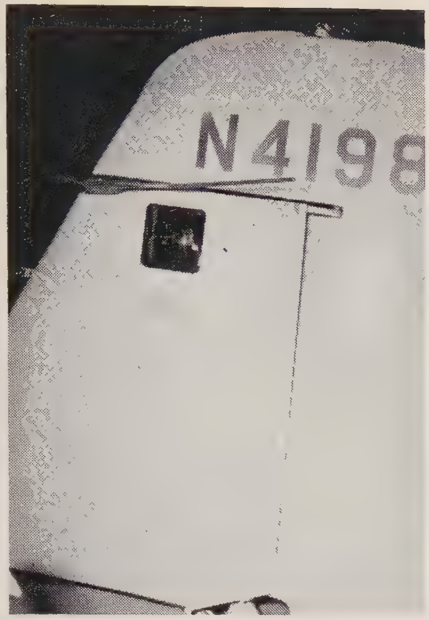
ACC Decision Guarantees DME in Operation Until 1960

Ambler, Pa. Assurance that DME would remain in operation for at least the next five years and probably longer, along the nation's civil airways was affirmed by the President's Air Coordinating Committee's recent decision that VOR/DME would not be replaced "until some succeeding common system had been adopted and installed on the Federal Airways System." This is welcome news to the many operators of DME-equipped business aircraft, both multi- and single-engine.

With this action, National Aeronautical Corporation immediately resumed deliveries of its Narco UDI-1 DME. Prior to the company's suspension of DME deliveries following the original ANDB split-decision recommendation that distance measuring service be discontinued after June 30, 1955, Narco had installed Distance Measuring Equipment in about 150 business aircraft, principally Douglas DC-3's, Lockheed *Lodestars* and Beech D18's.



X-RAYS *for aircraft structures is now being offered customers at the Burbank installation of Lockheed Aircraft Service, Inc. Here, Bob Reynolds, Lockheed technician, uses the Danish-developed x-ray unit to study the wing attach fitting of an executive Lodestar*



ANTI-COLLISION *light designed for a business Widgeon weighs just 2 pounds*

Anti-Collision Light Engineered for Small Business Aircraft

Amityville, N.Y. An anti-collision beacon for small aircraft has been engineered by Aircraftsmen, Inc., a service organization at Zahn's Airport. The first installation was made on the Lycoming-powered *Widgeon* operated by the Fuller Brush Co. A 12-volt Pounder Anti-Collision Light developed by Ace Foundry Co., of Chicago, was streamlined into a high position on the *Widgeon's* fin. On larger aircraft, the rotating beacons normally are placed atop the fuselage or fin, but because of the size of the domes in these installations such a position was not feasible on smaller size aircraft. The Aircraftsmen installation on the *Widgeon* requires only a 6-inch square opening in the fin and the red glass covering, made by Aircraftsmen, protrudes only one inch on either side. The light unit weighs 1 lb; complete installation, 2 lbs.

Beech Announcement of 760 Reflects Corporate Interest

Wichita, Kan. Announcement of Beech Aircraft's sponsorship of the Morane-Saulnier MS 760 four-place twin-jet business plane (*May issue*) has been received with a great deal of interest on the part of the owners and operators of executive aircraft. Facts of particular import to business-plane users are these: 1) The engines powering the MS 760 are available in quantity, and offer a considerable growth factor which could materially increase the cruising speed of the airplane. 2) The 760 features dive brakes, cabin pressurization and full air-conditioning, including cabin refrigeration for hot days. 3) Its structural factors of safety far exceed the requirements for modern transports. 4) East of maintenance is built-in. A complete change of both jet engines can be made in 50 minutes. 5) The MS 760's soundproofing is so effective that normal conversations are easy.

. . . . in the business hangar

Clyde Martin, chief pilot for Potlatch Forests, Inc., has his company's *Lodestar* back at home base in Lewiston, Idaho, after completion of radio system modifications and installation of new equipment including a Collins Integrated Flight System, a 51R-3 receiver and a C-4A Gyrosyn compass. The work was done by Qualitron at Burbank, Calif.

The Grumman *Mallard* owned by The Lyon, Inc., Detroit, has been at L. B. Smith Aircraft Corp., Miami, for routine maintenance. The *Mallard* was flown to Florida by Don McLott, pilot, and Fred Minden, copilot.

Pure Oil Company's DC-3 has been at Spartan Aircraft in Tulsa for 100 hour inspection. The -3's rudder and elevators were recovered and refinished, and a new Collins 17L-3 transmitter and 51R-3 receiver were installed. While this work was being done, the ship's glide path receiver was modified for six channels. Bill Burke flew the -3 to Tulsa.

First Colonial Investment Corporation's Twin Beech is back in the air after installation of new radio equipment by Dallas Avionics at Love Field. The equipment included dual VOR, dual VHF, ADF, ILS and a new custom radio and instrument panel.

The *Lodestar* belonging to The Great Lakes Steel Company has been at Page Airways, Rochester, for annual relicensing and installation of a Sperry Airborne Engine Analyzer system and a Bendix DME. Carl Gaenzler flies the *Lodestar* out of Wayne Major Airport at Detroit.

R. F. "Wimpy" Neel, pilot for The Brown Paper Mill Co., flew his company's DC-3 to Executive Aircraft Service, Dallas, for 100 hour inspection and miscellaneous repairs. Home base for the -3 is Orange, Texas.

Eastman Kodak's DC-3 is back in operation after recovering of its control surfaces and other repairs by Piedmont Aviation at Winston-Salem, N.C.

The Anheuser Busch-St. Louis *Cardinals* DC-3 was at Remmert-Werner recently for a double engine change. Pilots for Anheuser Busch are Walt Westerfield and Hank Gausmann.

Gulf Oil Corporation's Capt. Larson and Frances Volpe were at the controls of Gulf's Twin Beech when it came into LaGuardia and Air Radio Maintenance for installation of a Lear LVTR-36.

Capt. John Yost brought Armstrong Cork Company's DC-3 to Reading Aviation Service for an 8,000 hour inspection and major overhaul. In addition, a Narco DME and an Eclipse-Pioneer PB10A autopilot will be installed. The executive Douglas should be back in operation soon.

British American Oil Company, Ltd. of Toronto, Canada has taken delivery of its *Learstar* from Lear Aircraft Engineering. The actual delivery took place at McCarren Field, Las Vegas, Nevada, and Mr. R. J. McVicar, chief pilot for British American, accepted the aircraft from Lear's Mr. Elmer Easton. Feature of this high-performance executive airplane is a uniquely integrated installation which feeds navigational data from a complete Collins radio navigation system directly into a Lear L-5 autopilot which enables the aircraft to be automatically flown to any pre-selected destination within the service range of radio navigation facilities.

L. L. MacKinnon, pilot of Imperial Oil Company's Convair 240, brought the 240 to L. B. Smith Aircraft for work on its air-stair door and its auto-feathering and prop-reversing circuits.

Larry Montigny brought Dresser Industries' PV-1 to Spartan for 100 hour inspection and instrument, radio and engine maintenance. Larry is also his company's National Business Aircraft Association representative.

Republic Steel Corporation's two PV-1's are back in operation after extensive radio communications and navigation system modifications by Qualitron. T. A. Jones is Republic's chief pilot, and William B. Belden is NBAA representative.

Continental Oil Company's executive DC-3 is now carrying a completely new radio installation done by Dallas Avionics. Included are dual VOR, dual VHF, dual ADF, ILS, Gyrosyn compass, and custom overhead and glare shield panels. C. F. Zimmerman is Continental's chief pilot and NBAA representative.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

High-Density Air Traffic Test Endorsed for Washington Area

NBAA, the scheduled airlines, airline pilots and military forces have joined hands in supporting CAA's plan for a high-density traffic experiment in the Washington, D.C., area. At the recent special CAA hearing, all civil aviation representatives, except AOPA, endorsed the proposed operation. It was generally agreed that even in VFR weather conditions, a serious air-traffic problem exists in the Washington area and the proposed rules should be supported in principle because such action appears necessary to alleviate the objectionable condition. NBAA finds it difficult to understand why there could be any opposition to evaluation of needed safety measures, on a strictly trial basis, in a single location, when the results could open the way toward reducing the increasing mid-air collision hazard.

Other spokesmen challenged testimony given at the hearing that took issue with the necessity for conducting the experiment at Washington in light of traffic comparisions with other locations over the nation. It was pointed out that Washington's three airports (National, Bolling and Anacostia) are in the same control zone and the others are not. On this basis, it was concluded that Washington ranked second only to Chicago Midway-O'Hare in high-density air traffic.

In brief, the proposed special ATC rules would make the airspace from 1,000 to 3,000 feet above ground a "High-Density Air Traffic Zone." In this zone, *aircraft must at all times have workable two-way radio and maintain radio contact with the tower.* Except where higher speed is necessary for safety, aircraft in the zone should not be flown faster than 180 mph IAS. Through flights must fly above, below, or around the newly designated zone.

Subsequent reports will advise of the status of the proposed plan which is now being weighed by the CAA administrator for a final decision.

Present State of Aviation and the Tall Structures Situation

A temporary aviation working group has been established by the ACC joint Industry-Government Tall Structures Committee. The working group consists of representatives from the following agencies and organizations: Department of Commerce, National Business Aircraft Association, Inc., Department of the Army, Department of the Navy, Department of the Air Force, Federal Communications Commission, Air Transport Association, National Association of State Aviation Officials, Aircraft Owners and Pilots Association, Air Line Pilots Association, Airport Operators Council and the American Association of Airport Executives.

The group was directed to review the issues involving the safe, efficient and economic operation of aviation in relation to tall structures and to submit a report of its findings to the Parent Committee.

Factors generating a requirement for a study of the tall tower situation at this time, are summarized as follows: 1) The increasing number and height of tall structures required by the broadcasting and television industry. 2) Inability to forecast the future airspace requirements of the broadcasting and television industry. 3) The continued increase in speed with associated lack of maneuverability and the increase in number of civil and military aircraft, and 4) The failure of certain conditions and techniques to materialize as forecast in the 1952 Tall Tower Study.

As a member of this committee, NBAA is strongly opposing indiscriminate location and construction of tall structures exceeding 1,000 feet in the vicinity of airports and airways. More details will be provided as to the outcome of the dispute after the final report is available for publication.

Special Hearing Held on Annual Aircraft Inspection Rule Change

The CAB Bureau of Safety Regulation held a public hearing in Washington, D.C., on April 13 to discuss changes submitted by the industry to its proposal for elimination of annual inspection of general aircraft. The special session was mainly devoted to review of controversial items included in the CAB's initial CAR draft release 54-27.

NBAA members actively and vociferously participated in the proceedings and departed with the assurance that their requirements were fully recognized and that amendments of the following nature would be made to the proposed CAR and resubmitted to industry for further review and comment.

Period Inspection: Aircraft must have one periodic inspection annually by a rated certificated mechanic holding inspection authorization or by repair stations and certain manufacturers. Maintenance responsibility rests with owner or lessee.

Progressive Inspection: Allows progressive inspection by certified repair stations, certificated mechanic holding inspection authorization, and certain manufacturers. Compliance responsibility rests with owner or lessee. Annual periodic inspection not required if progressive inspection is used.

Mechanic Proficiency: Can be maintained by conducting four periodic inspections annually, or conducted or supervised progressive maintenance on at least one aircraft throughout year.

Letters of appreciation for NBAA's active role in opposing and helping to resolve the questionable provisions are arriving daily.

ACC Agrees on Program to Resolve TACAN Controversy

Unanimous agreement was reached on April 19 by member agencies of the Air Coordinating Committee on domestic and military system divergencies.

In the domestic program, provision is made for interim implementation of the minimum amount of military TACAN necessary to meet tactical requirements. Coordination of TACAN integration on federal airways is to be in accordance with policy developed by ACC. CAA will continue the VOR-DME system until a succeeding system is installed on the federal airways. If TACAN is accepted as the succeeding system, VOR will continue until 1965 and DME to 1960. ANDB also will study and report to ACC on the frequencies required for civil/military TACAN, an interim military TACAN and the relationship of TACAN to continued defense. ANDB is to appropriate studies on a third rho-theta system capable of meeting all common system requirements.

The international program provides for advising ICAO member states on present system developments or other possibilities for short-range navigation systems. In this connection, the United States plans to continue VOR service at its international airports at least until 1965. If the U. S. decides to adopt TACAN for the common system, it may not be able to continue DME service beyond 1960.

NBAA actively participated in the ACC NAV-panel meetings which considered the VOR/DME-TACAN dispute.

Safety Responsibility Study Initiated by CAA

The CAA director of aviation safety has formed a four-man committe to study CAA aviation-safety, industry-safety responsibilities. Interested industry associations have

been notified of the committee's work with a request "to secure preliminary opinions of the segment of aviation which your organization represents" on transfer and delegation of responsibility.

"It would seem" CAA said, "that the joint industry-government planning which is expected sometime after July 1 will benefit if all major parts of the aviation industry as well as government have developed their preparatory ideas on this matter."

Specific assignment of the committee is to develop "a comprehensive body of concrete proposals" on aviation safety activities which should be: 1) transferred to industry or private parties, including quite possibly some that are now handled through delegation; 2) delegated by CAA to industry; 3) eliminated or substantially reduced; and 4) changed basically in direction, management, approach and manner of execution to improve efficiency and economy.

The government committee appointed is composed of the following division chiefs: Chairman, W. H. Weeks, Aircraft Engineering; E. B. Franklin, Air Carrier Safety; E. W. Hudlow, General Safety; and W. R. Stovall, Medical.

Industry representatives have not been officially announced to date.

Dickinson Stresses Role of Business Aviation in Development of N. Y.

Pledging to promote the future of the aviation industry in New York State, Commissioner Edward T. Dickinson of the State Department of Commerce, recently declared, in his first statement on aviation, that it "is our intention to utilize the aviation industry as a nucleus for the growth of an even more balanced economy in the State."

"It is evident that business and industry in this State, as in the nation and abroad, are geared to the tempo of air commerce, which has established outstanding records for speed and safety."

He pointed out that in the last 10 years the growth of new airports and new commercial air routes in our State has provided business with improved tools for management, sales, maintenance of equipment and delivery of goods. "Business has been quick to utilize these new facilities," he said. "More than 300 firms in New York State operate their own executive aircraft for swift communication with their various branches and for general business use."

Attention!!!

Following is a quote from a letter received from an NBAA member who prefers to remain anonymous.

"We have experienced several wheels-up incidents over the past six years. Our aircraft operation personnel have devised a simple device utilizing existing components of the aircraft by which we hope to reduce the source of the potential accidents of this type in the future.

"The present landing gear warning system warns only against landing with the wheels up. A minor modification consists of a short piece of wire running from the negative circuit on the landing gear warning horn up to a switch on the landing gear selector switch safety cover door. With this modification, the landing gear warning system will warn against retracting the gear on the ground. This additional safety device does not in any way change or interfere with the standard landing gear warning system.

"The modification is being made on all of our Beechcraft and we are passing it on to you for information and any possible use you may make of it."

Air Traffic Activity

Recently-aired fight over TACAN and VOR/DME found the military and the airlines substantiating their claims to an air navigation system of their choice by claiming "over 80%" of instrument flying. According to traffic statistics for last year, they could have claimed over 90% since other civil traffic accounted for only 6% of the instrument approaches and 6% of Air Route Center's fix postings. Both figures are probably not truly representative since business aircraft generally are more inclined to fly VFR when conditions permit, or to cancel IFR as soon as VFR flight can be conducted. This results in failure to have instrument approaches logged and cuts down on Center's fix postings chalked up for other civil activity. If as many business aircraft, proportionately, filed IFR flight plans, regardless of weather, as do the airlines, and held on to them until landing, whenever the visibility was less than three miles or the ceiling was at or below the initial approach altitude, business aircraft, with a fleet nearly 10 times as great as the airline fleet, would chalk up a huge gain in traffic activity statistics. The gain in air route fix postings would be most important in indicating the extent of business aircraft's use of air navigation facilities.

Federal Radio Releases TACAN System Information

First announcement of TACAN "availability" was released recently by International Telephone and Telegraph Corp. According to the release, the equipment measures 7 x 10 x 15 inches, has an azimuth accuracy to "within 1°," and distance measuring accuracy of "the order of 2/10 mile." This "makes it superior to ordinary radar accuracy," IT&T said.

TACAN was described as an integrated system offering substantial saving of radio frequency spectrum space, large weight and volume savings, and maximum accuracy for a wide variety of siting locations.

"Large scale production" of TACAN, IT&T said, has been started by its subsidiary Federal Telephone and Radio Co., and by Stromberg-Carlson and Hoffman Radio.

New Aviation Film Available

Bendix Products Division of NBAA-member Bendix Aviation Corporation has announced a new aviation film available to the public. The following is a brief description of the new Bendix film release: The title is "Air Power on Parade." It is a 16-mm, color, sound film in a report to the nation on air strength. Bendix believes that an eyewitness view of Air Power on Parade is of prime importance to the American public. The film shows the Thunderbirds and Blue Angels in an aerial demonstration, a mock battle by the Armed Forces, Air-Sea rescue operations, a demonstration of air-to-air refueling, helicopter square dance performance and ground displays of the latest Armed Forces aircraft.

Copies of this film may be borrowed free-of-charge by addressing your request to Bendix Products Division, Bendix Aviation Corporation, South Bend, Indiana.

New Aviation Product

NBAA-member Monsanto Chemical Co., St. Louis, Mo., is distributing a booklet describing *Santolene C*, the company's "Single Treatment" rust and corrosion inhibitor, with a portion of the pamphlet concerned with use of the additive in aviation fuels. Write them for a copy if you don't have one.

NBAA Member Installs Radar

One of the first installations of airborne radar on a business aircraft was completed recently by NBAA member Page Airways, Inc., of Rochester, New York. The Bendix Airborne Radar System was installed in the nose of a Lockheed *Lodestar* operated by Forrest Oil Company of Brandford, Pa.

The new radar system was installed to provide better flight safety through storm areas. It gives the pilot enroute weather information, enabling him to avoid extreme turbulence, thus reducing the possibility of structural damage and affording a smoother ride.

The complete system weighs about 245 pounds.

New Propeller-Reversing Rule Adopted by CAA

All NBAA members using reversible-pitch props will be interested in CAA amendments to Civil Aeronautics Manual 4-B, establishing new policies for use in determining aircraft accelerate-stop distance and landing distance for aircraft equipped with these propellers. Up to now, authorization for computing these distances with credit for reversing had been granted only for the Boeing 377 operation of NBAA-member Pan American World Airways, at one designated airport.

The CAA rules provide that propeller reversing may be used in combination with brakes to determine distances if it can be proved that a level of safety equivalent to that of brakes alone is maintained. Pilot skill required and the possibility of attaining the necessary performance under simulated engine failure conditions also must be considered in applying the rules.

Pilot Reports

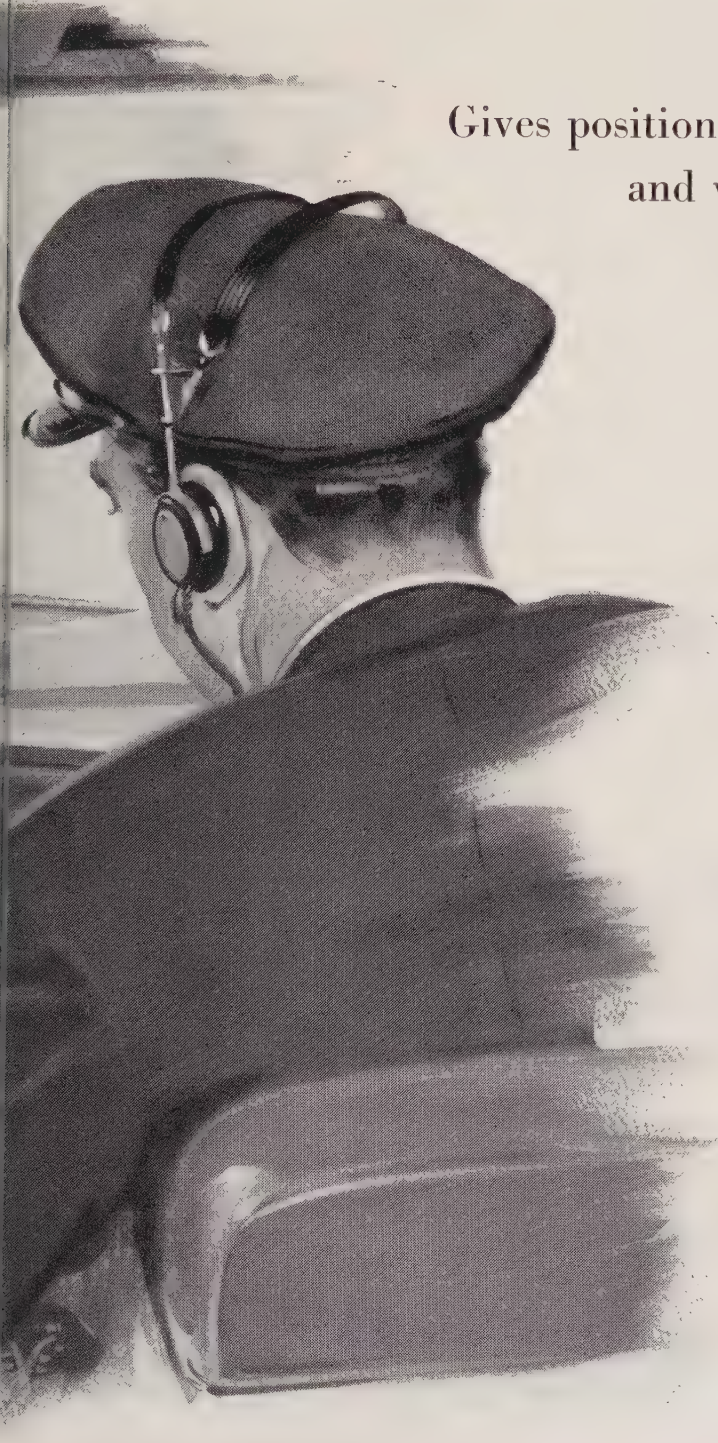
"There are still not enough pilot reports," says Chief Reichelderfer of the U. S. Weather Bureau in Washington. Urging pilots across the country to report weather enroute, the Weather Chief appealed to NBAA and other aviation organizations to pass the word along.

TACAN

will revolutionize

Amazing New IT&T development

aircraft navigation



Gives position of aircraft instantly, automatically, and with accuracy never before attained

TACAN (tactical air navigation) provides both distance and bearing information in a single "package" about the size of an ordinary shoe kit. This has never been done before!

By integration of functions, and miniaturization into one small unit, TACAN represents a giant stride in aircraft navigation equipment. Add extreme accuracy, and adaptability to varying installation conditions such as on shipboard or for mobile land equipment, and you know why TACAN is described by military and civil aviation officials as one of the most significant advances in many years.

TACAN is the result of a series of development programs sponsored by the U. S. Navy and the U. S. Air Force at Federal Telecommunication Laboratories, a division of IT&T. It is another of the outstanding IT&T research and engineering "firsts," and major contributions to safer, more dependable flying.

A light, simple, comprehensive TACAN airborne unit can be made available for private flying.

INTERNATIONAL TEL AND TEL

IT&T

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
67 Broad Street, New York 4, N. Y.

Silicone Lube for Jets Shows Outstanding Traits

To meet the burning, grinding demands of high-speed aviation turbines, Westinghouse Electric is testing a new silicone lubricant that shows promise of opening new doors of performance and durability.

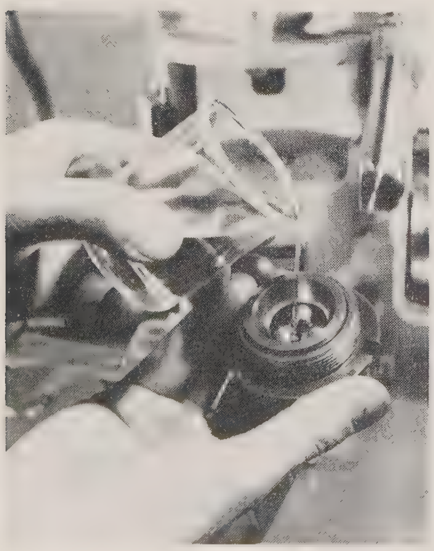
Already, according to company spokesmen, the new silicone fluid has passed thermal stability and viscometric test ranging from minus 65° F., to plus 500°. Steel-to-steel bearing tests have shown the new fluid to be capable of performing well and to maintain "excellent" lubricating qualities at loads up to 107,000 pounds per square inch bearing area.

Many past attempts to utilize the well-known thermal stability of silicone fluids to advantage in the lubricating of ferrous metal surfaces moving in the tolerances demanded in aviation turbines, have not been notably successful. In boundary lubricating conditions where the lubricant film between metal surfaces is close to the thinness of two or three layers of molecules, the silicones often have proved unreliable.

Credit for correcting this in the new Westinghouse fluid is given to Dr. Gordon Gainer, supervisor of chemical development activities of the Westinghouse Materials Engineering Department at East Pittsburgh.

His approach, the company says, was to actually modify the silicone oil molecule. What was wanted was a re-arrangement that would cause the silicone fluid to form a close-packed film or protecting layer on close-together metal surfaces.

As an indication of how successful the new fluid has been in achieving this, the company points to its test of it in the Shell Four-Ball machine. In this, one steel ball is rotated while held against three others; the entire assembly being immersed in the lube being tested. While the test ball is turned, the others may be forced against it under precisely controlled pressures to produce just the surface-to-surface tolerance conditions wanted. Pressures can be built up until the parts actually "seize" or weld together.



SHELL FOUR-BALL TEST—*Before testing, cup is filled with lubricant to be examined. The balls in the cup are held stationary*

PHOTO *made after test shows difference in lubricants. Top ball with smallest scar area was subject to pressure of 107,000 pounds per square inch; the center ball was tested in synthetic organic diester fluid; whereas the bottom ball was tested in a commercial petroleum-base jet lubricant*

It is in this apparatus that the new silicone fluid has been subjected to pressures of 107,000 pounds per square inch.

Presently available lubricants, the company claims, will permit "seizing" or welding of metal parts at between 14,000 to 27,000 pounds per square inch bearing area.

Furthermore, according to Dr. Gainer, "the new lubricant has also been tested in a Westinghouse turbojet engine. At the completion of this test, the engine was completely torn down and examined. No evidence of wear was found by the Gas Turbine Division engineers and the system was entirely free of any sludge derived from the new lubricating silicone oil."

At present the new-type lube is being manufactured by Dow Corning Corporation of Midland, Mich. The company is now supplying it to the military for testing.

Flying Red Horse Gets a New Name

During the current meeting of the stockholders of the Socony-Vacuum Oil Co., Inc., proprietor of the famous symbol and services of the Flying Red Horse, it was voted to change name to Socony Mobil Oil Co.

Jet Fuel Safety Factors Reviewed by Oil Institute

With jet-type fuels becoming an increasingly important factor in both civilian and military airport fueling operations, there is renewed significance in the basic information about the fuels as compiled by the Aviation Technical Service Committee of the American Petroleum Institute.

One of the most important areas covered in the Institute's researches into handling of these fuels concerns safety. In this, fire hazards are a prime consideration.

Relatively the least volatile of the fuels is the kerosene-type JP-1. Under normal ground temperature and atmospheric pressures, the API committee points out, vapor in the space above the liquid in a JP-1 tank is too lean to support combustion. If the fuel, however, is relatively warm and is subsequently carried to high altitudes where atmospheric pressure is low, then trouble is possible. Flammable mixtures will be formed, in such a case, above the liquid in the tanks.

Quite highly volatile, on the other hand, is JP-3, a gasoline-kerosene type fuel. At temperatures above plus 20° F., and at the atmospheric pressure of sea level, the vapor above the liquid in a JP-3 tank would probably be too rich to support combustion but would burn at filler necks or vents where it would have the opportunity to become mixed and thinned with outside air. At the same sea-level pressure but at temperatures between plus 20° and minus 40° F., there probably would be a flammable mixture of air and vapor above the liquid level in the tank. When it comes to spills, danger almost always is potentially present for combustible vapors are just about inevitable.

In between the two types mentioned above, in point of volatility, is JP-4 which also is a gasoline-kerosene type. In a tank at sea-level pressure and in a temperature spread of plus 80° to minus 10° F., there can be combustible vapors above the liquid level of tanks holding this fuel. Any ignition within the tanks under such a condition, of course, would produce an extremely violent response. If fire started, on the other hand, at a vent or filler neck, there would be a flash-in carrying the chain of combustion into the tank.

Fortunately, despite the hazards of handling this latter fuel, there is ample experience available to indicate that it can be done safely and efficiently. Many solvents which are stored under similar conditions and subject to similar handling methods have roughly the same vapor pressures as JP-4

Vapor space in storage tanks (the source of most concern) may be eliminated where such a precaution is deemed essential as a back-stop to all the other normal precautions. Such devices as floating-roof, water-displacement, or floating-diaphragm tanks can turn the vapor elimination trick.

Hand in hand with concern about fire hazards is the problem of static electricity. The problem is familiar, of course, to all fueling operations and, in some respects, represents one of the most constant matters to be coped with inasmuch as *any* fuel pumped through a servicing hose may build up a charge of static electricity.

In servicing craft with great fuel capacities—and most jet fuel users would be numbered in this class—the amount of the charge may increase. It goes up with a high linear rate of fuel flow.

Too, the accumulation of a static charge is greater with jet fuels than it is with ordinary av-gas. Higher specific gravity and wider boiling ranges are active in this factor. Thus, with all fuels and even more acutely so with jet types, the API aviation group sounds repeated warnings against any lapses or negligence as to electrical grounding or bonding of servicing equipment *and* the aircraft being serviced. These precautions are absolutely essential.

In case of fire, however, the same means of extinguishing used in the case of ordinary av-gas or other petroleum fires are effective in controlling jet-type blazes.

In subsequent issues, because of the increasingly general importance of these types of fuels, SKYWAYS will discuss various other phases of the American Petroleum Institute's recommendations and reseaches into the handling and uses of the fuel behind the power of the jet age.—Ed.

"One-Treatment Fluid" Fights Av-Gas Rusting

To fight the "silent enemy," rust, in the storage and distribution of fuels, Monsanto Chemical Co. has just announced a new "single treatment" rust and corrosion inhibitor. An ashless, organic liquid, the new inhibitor fights corrosion by forming a barrier film on metal surfaces contacted by the fuel.

Said to be compatible with anti-oxidants, scavengers, dyes, and other additives used in various fuels, the new compound is called *Santolene C* and is so completely soluble in clean petroleum products that it can be put in effectively either by injection or simple mixing through hundreds of miles of pipelines and into the distributive facilities beyond the line.

Only apparent sacrifice in fuel quality that is made in order to use *Santolene C*'s rust fighting qualities is a slight increase in gum content.

However, Monsanto points out, *Santolene C* does not adversely affect the water tolerance of aviation fuels.

In tests conducted by the company, dosages of as little as three pounds of *Santolene C* per thousand barrels of aviation gas proved effective, although the company's suggestion for "normal" dosage is five to seven pounds per thousand barrels.

Here are some of the pertinent comparisons between specifications of grade 100/130 aviation gasoline before and after addition of three pounds *Santolene C* per thousand barrels:

	Before	**After**
Gravity (API)	67.9	67.9
Color (Saybolt)	Green	Green
Freezing Point	below —76 F.	below —76 F.
Sulfur-Lamp	0.033	0.031
Lead-ml/gal	3.95	3.98
Octane-Aviation	Iso. Oct. plus 0.04	Iso. Oct. plus 0.02
Octane-supercharge	ditto plus 1.38	ditto plus 1.30
Gum—Cu Dish	0.8 mg.	0.6 mg.
Gum—ASTM	0.2 mg.	0.6 mg.
Gum—16 hr ASTM	0.8 mg.	1.4 mg.
Water Tolerance	Immiscible	Immiscible
Aromatics	10	12

In a more detailed study of the fluid's one disadvantageous area, gum content, Monsanto used the relatively high inhibitor doses of from 12 to 25 pounds per thousand barrels of fuel, the 12-pound dose brought the factor to a minimum of 1.5 and to a maximum of 2.3 in separate tests. The heavier dosage raised the existent gum factor to 3.2 in one test and 3.3 in another.

Counterbalancing that factor is the company's stated results of actual rust inhibiting accomplished by the new fluid.

Using only two-and-a-half pounds per thousand barrels of aviation gasoline, the company tested the value of the new compound in the long-term storage of av-gas in steel drums. The scale they used to rate the rusting in the drums ranged from 1 (no rust) to 7 (severe rust) and is based on the standard scale of Humble Oil Co.

After six months storage, treated av-gas that rated at 2 (barest traces of rust, a not-unusual normal rating) was tested again. It still rated 2. Even in the least successful of the tests published by the company, the rust rating raised from 2 to only 3 in which less than 5% of the surface was reported rusted.

AF-Type Fuel-Gauge Tester Now Available Commercially

Liquidometer Corp.'s Model EA-810 direct-reading portable test unit for the installation and maintenance of capacitor-type fuel-quantity gauging systems is now available commercially after having been supplied to the Air Force as Type MD-2.

The unit is designed to permit accurate field and shop testing of fuel gauge components requiring measurement of capacitance and/or insulation resistance. It weighs only 17 pounds and is adaptable to various non-aviation industrial test applications for similar measurements.

Capacitances of up to 5,000 micromicrofarads can be tested with only 25 volts of AC current applied to components, according to Liquidometer Corp. Should a short circuit exist in the unit under test, resistors are included in the circuit to limit the test current flow to 0.2 amperes. Included in the measuring circuit is a highly accurate, self-balancing transformer bridge, and a direct-reading indicator calibrated in micromicrofarads.

Using only 50 volts of DC current applied to components, insulation resistances of up to 10,000 megohms may be tested.

A selector switch, simply operated, enables making both capacitance and resistance measurements without changing leads.

LIQUIDOMETER *portable test unit for fuel gauges is now commercially available*

And, to adapt the connector cables to tank units of varied manufacture, a complete set of plug and jack-type leads is provided with the unit. For minimum leakage throughout the unit, Teflon-insulated wiring is used.

The specifications met by the new commercial version of the Air Force MD-2 tester are Mil-T-4687.

Liquidometer's address is Stillman Avenue and 36th and 37th Streets, Long Island City 1, New York.

Gulf Grades 50, 60 Given New Qualities

After seven years of testing, Gulf Oil Corp. has made what it terms "major improvements" in its Gulf Aviation Oils, Grades 50 and 60. The oils, designed for airlines, airplane manufacturers, and engine overhaul shops, have been reformulated to achieve increased performance.

Gulf claims "improved engine overhaul periods, low engine wear, and reduced combustion chamber and general engine deposits" among the features of the lubes.

The reformulated oils are straight mineral oil blends of selected mid-continent solvent refined stock. During the seven years of testing, aircraft engine research was conducted on combinations of crude oils, bright stocks, neutrals, and refining processes.

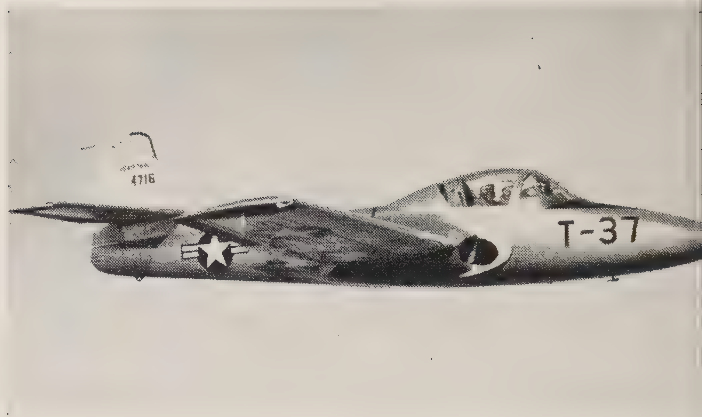
Another feature of the newly specified oils is that the viscosity index has been increased. A shift in blending stocks, Gulf has announced, has reduced flash and fire test temperatures. Bearing corrosion and gear load characteristics also have been checked out as superior to the old formulas.

In the 50 Grade a pour point depressant has been added to improve starting at low temperatures and assure proper viscosity.

In the 60 Grade oil, Gulf has added an anti-foam agent to assure minimum foaming.

Requirements set forth by makers of both radial and horizontally opposed engines are met by the newly reformulated products, Gulf announced. Among the approvals is that of Pratt and Whitney.

For the Air Force



Cess

FOR THE BUSINESSMAN...

Transportation that's

Immediate transportation that takes you where you want to go, returns you straight home. You set your own schedules. Gives flexibility to your business. Your best men can be more places "in person."

Prestige transportation that reflects successful business operation, modern thinking. Creates favorable impressions among your customers and prospects. Adds importance, increases stature of your personnel.

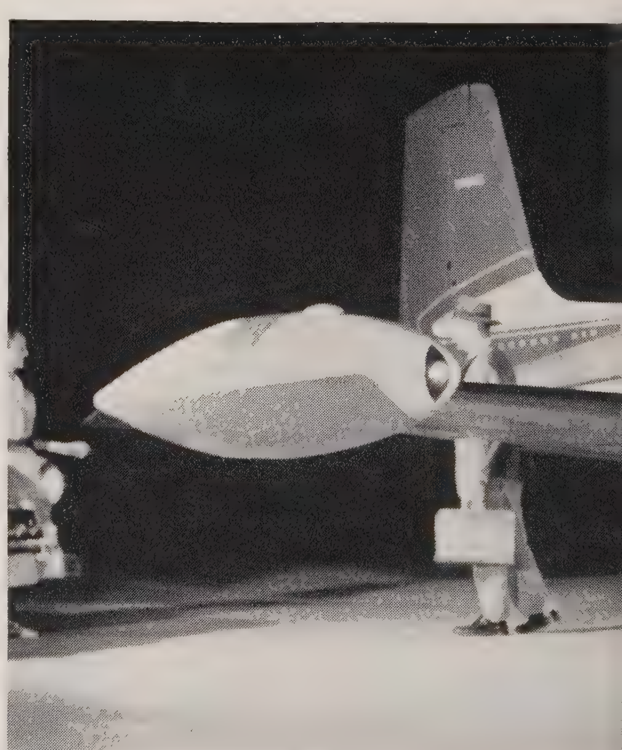
Economical transportation that c traveling costs, adds profitable m hours to your operation. And, easy for you to learn to fly, or th are many fully qualified pil available.

Cessna 180

Cessna 170

All-Metal Cessna 170

Built like the airliners. Has riveted-seam all-metal fuselage. Only all-metal airplane in the low-priced field. Has 100 "plus" features not found on other low-priced planes. $8,295 f.o.b. Wichita.



Powerful Cessna 180

Nowhere else can you buy over 150 m.p.h. cruising speed, amazing cabin quietness, comfort, luxury, smoothness of this 4-place airplane at anywhere near the same price. Only $12,950 f.o.b. Wichita.

Hood and Enroute Check

(*Continued from page* 11)

as there were pilots, and it was just as quickly realized that some sort of control over the pilots and some uniformity in operating methods had to be maintained. It was this that brought about the establishment of Check Pilots and the decision to require each flight officer to take a so-called "hood check" every six months in order to make certain each pilot's methods assured safe and efficient air-transport operations. Each airline thereupon assigned a Chief Pilot to each area or division of its routes, and the airline's pilots based in that area came under each Chief Pilot's jurisdiction and control.

While this brought about a semblance of standardization in pilot procedures and safety practices, the steadily increasing number of aircraft, both military and commercial, occupying the airspace just prior to World War II added to the burden on Air Traffic Control and it became apparent that if ATC were to carry on its job, it had to be certain every pilot would not only do an accurate job of flying but that all pilots would think alike when it came to procedures, modus operandi, etc. This brought about establishment of the Enroute Check, also on a six months basis.

Shortly after the war, the Federal Airways system, now with Omni, ADF and ILS as aids to navigation, was expanded until there was little airspace that was not controlled. Where, for example, there had been only 36 airways routes between the New York and Cleveland areas in 1935, there now exist so many that a look at the New York-to-Cleveland facility chart makes even a pilot dizzy. In the 1935-1937 period a pilot could remember every heading to fly and every holding procedure. Soon after World War II this became an impossibility.

There also was the speed of aircraft. Where, before the war, the DC-3 and the Twin Beech had shared a 180-mph speed bracket, after the war aircraft were operating at speeds of 180 and 250 mph and oftentimes "on the gauges." Though improvement in the safe and efficient operation of air transports was noted, thanks to the hood and enroute checks being given, there were differences in those checks.

In 1950, the CAA, the air carriers and the military services joined forces to formulate a standard pilot's proficiency instrument check and an enroute proficiency check. Today, unlike yesterday, the checks being given pilots of both the airlines and the military are alike, and all pilots are performing certain operations in a like manner. The "doing" is alike and so is the thinking. Proof of this can best be brought out by taking a look at some figures. In 1947 in the U.S. there were 102,873 instrument approaches (civil aircraft only) controlled by Approach Control towers. In 1950 there were 288,160 instrument approaches—or more than a 100% increase. In 1954 this same Approach Control group logged 406,853 instrument approaches! Add to this figure the Centers' score in '54 of 515,000 instrument approaches and you have an imposing figure resulting, in the main, from precision and coordination on the part of all pilots concerned.

At the close of World War II another class or type of air transportation made its presence felt—the business plane. And it, like the air carriers in the 1930's, is today in the swaddling clothes of growth and development—a growth nurtured by industries' efforts to decentralize operations, and a development fostered by the availability of electronic equipment to give aircraft close to all-weather flyability.

Today, there are many thousand single- and multi-engine aircraft being used solely for the transportation of company executives, engineers, sales people and even customers between factories, city and town centers, and outlying industrial areas. Most of these aircraft are equipped with the latest and best in electronic navigation and communication aids, and as such are expected to offer their owners the same reliability in scheduling as do the airlines. These company planes are flown "on the gauges" and at speeds that vary between 130 mph and 300 mph. But Air Traffic Control continues to operate according to methods most of which were devised back in 1935. What improvements have been effected in ATC have merely put more aircraft in the airspace.

Compare the air traffic picture in 1935 with that of today. In 1935 the air carriers owned and operated some 200 aircraft; there were few airways and only one airport served a metropolitan area. Today, the air carriers are operating close to 2,000 aircraft, and there are some 17,000 single- and multi-engine aircraft owned and operated by individuals and corporations in the interest of business.

What does ATC expect in 1960? A very comprehensive paper compiled by the CAA and the New York Port of Authority indicates that with single runways at Newark, LaGuardia, Mitchel, Idlewild and Teterboro, the CAA and the Port Authority anticipate 240 approaches per hour; if dual runways are used, that figure will be doubled. With radar control, the area capacity approaches 400 per hour.

Therefore, it is obvious that everyone operating aircraft must do and think alike when it comes to those operations in order to insure an orderly and safe flow of traffic. The time has come when, in the interest of safety to all, company pilots must establish operating procedures in much the same way the airlines and the military did some years ago. Equally important, the pilots must adhere to them. Some of the pilots flying company aircraft came from the military ranks and many have had no check rides since they last flew for Uncle Sugar. Fortunately, most pilots recognize these changing times and realize that a check flight which will call attention to their mistakes or their need for up-dating is a "must." However, there are some pilots and executives who consider this an unnecessary expense and a waste of time.

In the opinion of many pilots and Government officials alike, a continuation of that attitude will produce a compulsory check or some sort of CAA supervision.

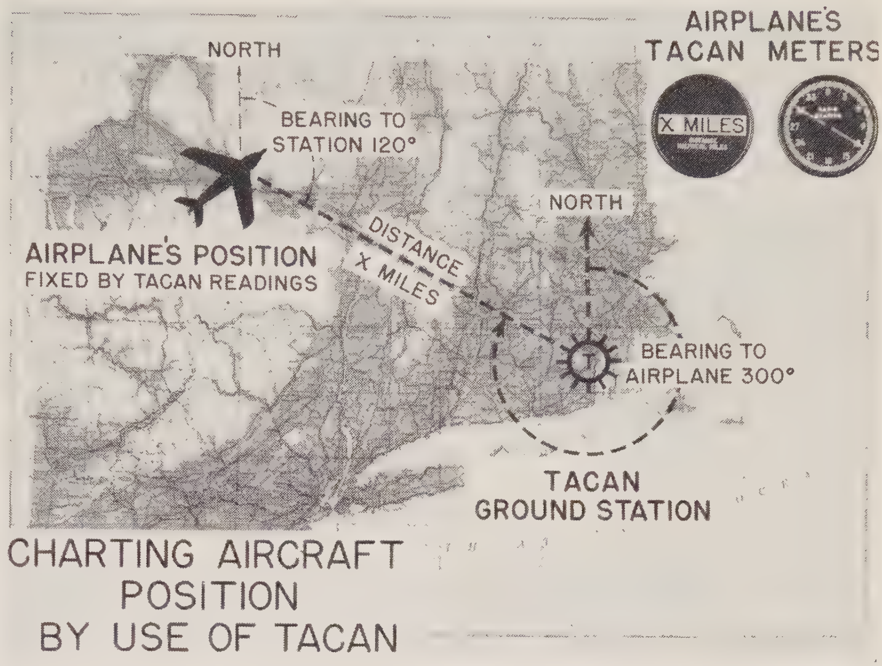
It appears that the only sensible solution for the future is that everyone who contemplates filing an instrument flight plan take periodic instrument and enroute proficiency checks. Thus, all pilots will be granted some assurance that the safety standards will be maintained and even improved in the future when the airways become more crowded.

IT&T Announcement of TACAN Marks Beginning of Govt "Sell" Campaign

Civil aviation in the United States has enjoyed a unique position in that it always has had a say in the development of its own future. In the rest of the world, what little civil aviation has existed has necessarily been solely the tail of the kite of military air power. Since World War II, the trend here has been gradually away from the dominant influence of civil over military, so typically American, and more toward the inescapable recognition that national survival demands yielding to the needs of the military.

Without outstanding exceptions, domestic civil aviation fought the introduction of the nautical mile so necessary to global navigation. Today, it is almost universally accepted. The number of requests by any civil pilots for towers, communications stations or weather offices to convert distances or velocity data from knots to miles per hour, are so few as to be fair justification for concluding that pilots either completely accept the nautical mile at this date or just don't care.

The same is true with the once highly controversial ICAO International phonetic alphabet. With such few popular exceptions as DOG, MIKE and CHARLIE, most pilots originate their identifying calls with the new alphabet. This acceptance of paternal compulsion by the military could be both bad and good. If the military were never mistaken, it would be good. Since they are not *always* wrong, it is not always bad.



CHARTING AIRCRAFT POSITION BY USE OF TACAN

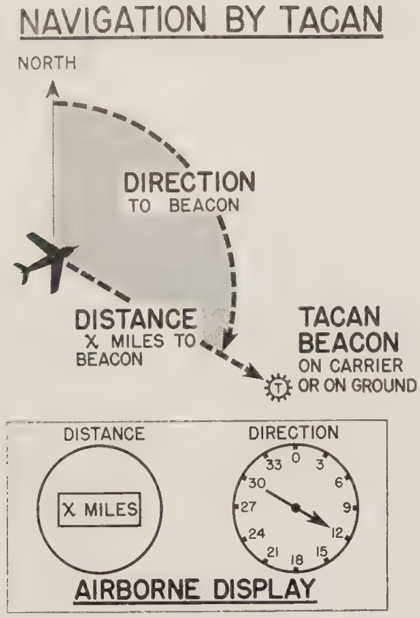
FEDERAL LAB *microwave tower is site of TACAN antenna. Development, testing took place here and at Westchester Airport, N.Y.*

So it appears to be with TACAN. It is good that they did go ahead in outrageous violation of their pledged acceptance of VOR/DME, for without that action we might be without an up and coming advanced technique for aerial navigation, potentially superior to the current VOR/DME system. Also, it is good that the civil agencies and airway-user groups rose up in righteous anger to cry out against the questionable tactics of the military services—if that's where the blame rests—civil economy from which their own largess eventually flows.

It is truly unfortunate that it was not recognized publicly from the start that whereas VOR/DME is so far superior to the old four-course LF range navigation system, it still has inherent deficiencies that have been little improved in almost 10 years of VOR and less than five years of DME. Unreliable and erratic courses are too frequent to warrant the close separation for increased traffic handling that was predicted for the VICTOR airways, and the major gain has been static-free reception of VHF and ease of visual tracking.

What does TACAN offer? As pointed out by its opponents, it *promises* to be a system combining all the advantages of VOR and DME into one integrated unit, with accuracy three times greater than the VOR/DME combine. We say "*promises*" because, despite recent releases by the manufacturers, no public information has yet been developed to assure that the above stated claim is a practical fact. If it is true, then all effort should be placed behind accelerated development so that it can be demonstrated and the flying public will go over to it as willingly as it has accepted every other real advance in navigation techniques.

Federal Telecommunication Laboratories, a division of International Telephone & Telegraph and the prime developer of TACAN, claims large savings in volume and weight of airborne equipment over the combined VOR/DME. Integrating of the azimuth and distance functions into the same radio frequency channels and circuits has resulted in significant reductions in the number of antennae, cables and other components. Reduction of the frequency spectrum employed offers considerable advantage in the multiplication of available frequencies, currently such a problem with VOR/DME. Another "virtue" via



PILOT *selects radio channel corresponding to ground TACAN station and obtains distance and direction to that ground point*

TACAN is the virtual elimination of siting problems which have been the worst bugaboo of VOR installations. TACAN operates almost anywhere, aboard ship or on land, and is as easily installed as the latest portable-class omni's.

The ACC (President's Air Coordinating Committee) made its decision and announced April 20th that the military should go ahead with the development of TACAN and implement it for *minimum military tactical requirements only*. Meanwhile, care is to be taken to avoid operational interference with existent DME channels and the forthcoming radar safety beacons. The CAA was directed to continue the VOR/DME system as the common system, VOR until 1965 (as before), and DME until 1960 pending further demonstration that TACAN might merit replacement of both.

Race For Extra VHF Channels Continues

In a move designed to protect their customers' investment in earlier transmitter models such as the T-11B, Aircraft Radio Corporation (ARC of Boonton, N. J.) has announced a 10-channel Crystal Adapter. By thus providing twice the channels on each set, a dual installation not only provides the desirable cross-check VHF navigation facility on both VOR and ILS, but adds virtually all the channels necessary to meet all non-airline communication needs. This is particularly important to the operators of

Air-Aids Spotlight

ATLANTA, Ga.—Radar and associated services out until Oct.

BIG BEND, Tex.—VOR permanently decommissioned.

BRISTOL, Tenn.—LFRange "TRI" temporarily operating as radio beacon only.

BURBANK, Calif.—CANOGA PARK radio beacon now operating as ILS Outer Comlo, identification "BU."

CAMAGUEY, Cuba—Radio beacon now on 920 kc, identifying "CMJL."

CHARLESTON, W. Va.—ILS Outer Compass Locator now on 251 kc.

CHICAGO, Ill.—Midway Tower frequency 118.1 mc transferred to O'HARE Field in lieu of 118.3 mc.

COLUMBIA, S. C.—VOR due to resume operations at new location approximately 6 mi SSE of airport.

DANVILLE, Va. — VOR at SOUTH BOSTON now identifying "SBV."

DETROIT, Mich.—New WILLOW RUN Airport TVOR on 111.4 mc "YIP" located 3 mi east of boundary. Add tower frequency 121.3 mc.

ERIE, Pa.—PORT ERIE ILS shut down indefinitely. LOM approach okay.

FARGO, N. D.—LFRange and associated markers due to resume operation after temporary 2 months shut down.

FORT SMITH, Ark.—ILS Localizer and LMM inoperative until November. LOM okay.

GREENWOOD, Miss. — VOR out until September for relocation WSW of airport.

HARRISBURG, Pa.—ILS Localizer commissioned on 109.9 mc serving Runway 8 with LOM on 219 kc, LMM on 201 kc; check tower for altitudes, transitions, procedures pending chart issuance.

HOULTON, Me.—BVOR due in July on 112.3 located 5 n mi SSW of airport.

HYANNIS, Mass.—Radio beacon on 239 kc moved 4 s mi NNE approach end Runway 4 for new and better ADF approach.

INDIANAPOLIS, Ind.—Center frequency 124.1 mc located at SPRINGFIELD, Ohio for better communications in Dayton area.

KANSAS CITY, Kan.—VOR approach approved to FAIRFAX Airport; new BLUE SPRINGS VORW on 116.2 mc "BSP" located 10 mi east of INDEPENDENCE, Mo.

KEENE, N. H.—Radio beacon frequency now 224 kc, identifying "EEN."

LONGVIEW, Tex.—VOR (and GREGG County Airport) identification on V-114 (DALLAS to SHREVEPORT) changed to "GGG."

LOS ANGELES, Calif.—VAR decommissioned. Replaced by BVOR on 113.6 mc 1 mi west of airport.

NEW YORK AREA—VICTOR AIRWAY 46 (RIVERHEAD to NANTUCKET) restricted by new MONTAUK POINT anti-aircraft firing area 0830 to 1630 Monday thru Friday, unless ATC-approved. VICTOR 30 extended from MASTIC to intersect NANTUCKET 267 radial, and VICTOR 46 South designated (RIVERHEAD 122 radial to NANTUCKET 267 radial) to bypass area.

—Due to Center Radar at

(*Continued on page* 34)

medium and light twins as well as single-engine executive aircraft where the 180-360 channel equipment is either impractical or too costly.

Entering the same field for the same purpose but with a separate package, North American Aviation, of Downey, California offers a new rugged, lightweight 8-channel, miniaturized VHF transceiver. Occupying less than 1 cubic foot of space, and weighing 20 lbs complete, the unit is composed of eight individual assemblies which are plugged into the set for easy replacement in event of failure. Thus, not only should labor repair costs be low but, conceivably, replacement could be accomplished by the pilot.

Aerotron Develops Electronic ADF

With the influx on the market of multi-channel VHF for the single- and twin-engine light executive-type plane, there has been some indication that manufacturers are preparing to drop the LF receiver from their combinations. In fact, no major firm today is offering separate LF equipment.

The users, while having screamed loudly over the CAA's program of gradually eliminating the LF ranges, actually have encouraged the program by their ever-diminishing air-to-ground calls requesting reply on the LF frequencies. Few newly delivered aircraft lack at least one VHF navigation and communication receiver as the basic component of the combination.

The often-distressing shortcomings of VHF (such as altitude and line-of-sight limitations) have emphasized the importance of having *at least* one LF and one VHF. For some time, the airlines and operators of similar equipment have accepted the advantages of dual ADF and VOR equipment.

Another important fact is that, for every four-course LF range that is removed from operation, at least one and often two LF radio beacons make their appearance.

Until now, any thought of adding a first or a second LF/ADF to an aircraft in the single or light-twin class has brought up the question of cost, weight and space. On the other hand, the comparatively small market that light aviation offers to radio manufacturers has balked any large, unsubsidized investment for development of a line of really low-priced ADF's and other radio accessory equipment that is usually found in larger aircraft.

The Aerotron Co. of Raleigh-Durham Airport, N.C., has made a dif-

ferent approach to the problem. By abandoning long-established circuitry and radio methods, the company has been able to produce a working equivalent of ADF for a fraction of the cost in material, labor and circuitry. By employing electronically rotating fields and grouped sub-assembly components, they have made it possible, for a modest cost, to add station finding, ambiguity resolution and automatic *homing*, to any LF or MF receiver currently in an airplane.

Described as "the poor man's Automatic Direction Finder," it may at first be challenged by those accustomed to thinking in terms of the familiar radio compass, with the 360° rotating needle. The company itself makes no such claim, preferring to call the instrument an "Electronic Direction Finder." The important fact is that, with the Electronic DF the major hardships associated with LF navigation are reduced to an acceptable minimum. Inexpensive, proven-reliable LF receivers that up until now were fast losing their justification on the panel have now become worth many times their former value.

Employing a flush-mounted antenna, no extra drag is added to the airplane, and total weight of antenna, cable and indicator is 3 pounds. The indicator, of course, fits a standard panel hole.

Employing a separate *"ON-OFF"* control, the instrument merely gives a *"LEFT-RIGHT"* indication resembling the early pre-war Bendix fixed-loop installations (but without the high-drag loop) and it is incomparably lighter, cheaper and more accurate. Ambiguity is resolved, of course, by kicking rudder slightly. If the needle swings *away* from the turn, the station is ahead, if *with* the turn, it is behind.

Bearing sensitivity is such that as the station is approached, the usual practice of reducing the increasing volume, tends to keep the sensitivity constant and thus a reasonably good track can be made despite anything but a severe crosswind. Aerotron expects to add qualitative reference marks to the dial similar to the ILS cross-pointer dot system. Additionally, as the plane drifts off course, the EDF creates a high pitch (400-cycle) tone through the receiver as notice to the pilot, making constant guard of the indicator unnecessary.

Aerotron claims their instrument is relatively free from electrical static influence in that such effect tends to cancel itself out in their circuitry. Working as it does with low frequencies, it happily lacks the line-of-sight disadvantage of omni.

A full-size ADF in a complete package is in the works at a price and weight that will be about halfway between the "under $200" price of the EDF and the price of the next lowest ADF.

Isolation amplifiers, found so valuable in airline operation, are equally scarce in light single and twin-engine aircraft. With two or more radios in use in an airplane, only a control-tower operator can make usable sense out of the simultaneous emissions from both through one speaker or headset. Where two pilots are flying in the same aircraft, the previous weight and cost penalty of an isolation amplifier made it another gadget to be desired but not procured. Aerotron plans to put a relatively inexpensive one on the market shortly.

To their already announced 10-channel VHF transmitter that sells for $79.50 (now piling up a backlog of orders), Aerotron is adding a comparable VHF receiver, And in a very short time, subject to military priorities, Aerotron hopes to offer a complete package with every radio navigation/communication facility available except DME. And on that score, Aerotron won't talk.

To get maximum performance from your DC-3...

you need an AiResearch 26,900 lb. Gross Weight Flight Manual

Guessing about the capabilities of your DC-3 can not only be uneconomical . . . it can be downright dangerous. The AiResearch 26,900 lb. Gross Weight Flight Manual provides complete operating data for DC-3s equipped with P&W R-1830-75 or R-1830-94 engines under all load and altitude conditions.

This manual gives you length of runways required for take-off and landing, rate of climb and the proper power settings for maximum economy and range. It tells you how to get in and out of any airport in the United States.

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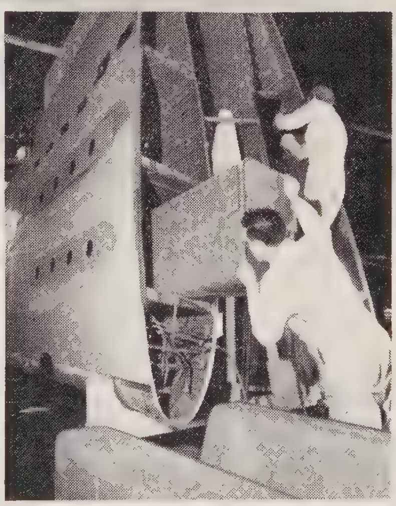

800 MILES MORE RANGE for DC-3s is achieved through the exchange of wings containing auxiliary fuel tanks with 400 gallons added capacity. By exchanging wings, installation time is cut in half.

SAFETY FACTOR FOR LODESTARS INCREASED by replacing present integral tanks with Goodyear nylon fuel cells. Experienced, licensed mechanics at AiResearch Aviation Service have made this installation for many Lodestar owners.

PAR Two-Axis Autopilot Test Flown in Army L-19

Flight acceptance tests of Summers PAR Pilot, highly regarded two-axis autopilot for light aircraft, was staged recently in an Army L-19 "Bird Dog" with Lt. Conrad J. Provencher at the controls.

Flying out of Santa Monica Airport, the Ft. Huachuca, Ariz., officer put the little reconnaissance aircraft through shakedown maneuvers in order to evaluate the control system for the Army Signal Corps. According to Al Hanes, company chief pilot who rode as observer, the PAR Pilot performed in model fashion.

Hanes reported the compact 16-pound autopilot was engaged (Control knob centered) in a 40° bank. "Return to straight flight was made smoothly," he added. With the control knob turned full right, the PAR Pilot was engaged in a second 40° bank. The system immediately lessened the bank angle to the normal 18°, 3° per second rate of turn. Forced off of heading 25° and rolled to the right 45°, the L-19 was returned to its original heading and level flight attitude in just 40 seconds.

Praising the autopilot's reaction to stalls, Hanes wrote: "Throttle was closed on the aircraft and the trim tab rolled to its stop, causing the aircraft to climb. The autopilot held the wings level and, when a stall was approached, kept the wings level until the nose would drop enough to pick up a little speed. The increased speed would again cause the nose to rise and the sequence repeated again. Change in pitch was about 5°. The aircraft could not be forced into a stall without help from the pilot by his forcing the stick back."

With the autopilot engaged after the L-19 had entered a spin, recovery was effected in one-half revolution of the aircraft. On a check of the system's ability to hold the aircraft on a straight course, deviation was found to be less than one degree, even in rough air.

Air-Aids Spotlight

(*Continued from page 30*)

MITCHEL) need for frequencies, LGA Approach Control secondary frequency 125.5 mc transferred; also Center now using 124.7 mc for COLTS NECK traffic; 124.3 mc for MILLVILLE-DOVER-COYLE traffic. IDLEWILD Approach Control now 124.9 mc.

NORFOLK, Va. AREA—LFRange now on 281 kc, tower on 396 kc. New WAVERLY, Va. LFRange commissioned on 239 kc "AVR" located PETERSBURG, Va., and ELIZABETH CITY, N. C., with NW-SE courses aligned parallel to overcrowded Green Airway 6.

NORTHEAST U. S.—CAA Region One may drop policy of shutting down ILS Glide Slope when Localizer inoperative where ADF or other type approach synonymous with Localizer course and Glide Slope information could assist approach.

OLYMPIA, Wash.—New VORW at airport on 115.4 mc "OLM."

PHOENIX, TUCSON, Ariz.—South course PHX LFRange swung westward 12° to 346°; West course of COCHISE LFRange swung South to 63° plus recommissioning of TUCSON LFRange has resulted in re-alignment of Green Airway 5 and Red 83 CASA GRANDE intersection moved 8 mi west. TUCSON radio beacon replaced by LFRange, courses 63°A, 123°N, 262°A, 324°N, located so that east course lies over airport 12.5 mi. SAN XAVIER MISSION FM (one dash 4 mi west of airport. GILPIN FM now four dashes and VAIL FM now identifying "U."

PITTSBURGH, Pa.—Decommissioning of Greater Pittsburgh Runway 32 ILS and approach lights now scheduled for June; also transfer of frequency 110.3 mc and identification "PIT."

RALEIGH-DURHAM, N. C.—ILS Glide Slope, Middle Marker and neon approach lights decommissioned for runway lengthening. Tower frequency now 119.3 mc.

ROCKY MOUNT, N. C.—New VOR is on 116.5 mc at old VAR site.

ROSWELL, N. Mex.—VOR out until September for relocation.

SAN JUAN, P. R.—Tower and Approach Control facilities moved from ISLA GRANDE Airport to SAN JUAN INT'L at ISLA VERDE.

SANTA MONICA, Calif.—TVORW (city-owned on 110.8 mc "SMO" located just off SW side of airport.

SEATTLE, Wash.—SHELTON LFRange on Blue 71 converted to ADF beacon; Fan Marker now identifies "K." SEATTLE-TACOMA tower frequency 118.1 replaced by 118.5 mc.

SYRACUSE, N. Y.—ILS Glide Slope, MM and LOM relocated eastward easing approach. Outer Marker altitude now 1600', Middle Marker altitude now 610', approximately .65 s mi to runway.

TAMPA, Fla.—VOR moved to PINELLAS County Airport.

TIJUANA, Mex. — Another MHW radio beacon on 381 kc "TNA" located southwest of airport about 3 mi.

WEST PALM BEACH, Fla.—LFRange and VOR approaches cancelled. Superseded by special Air Force procedures unpublished.

WILKES BARRE-SCRANTON, Pa.—LAKE CAREY and E. SCRANTON fan markers decommissioned.

Announcing the Formation of the NATIONAL PILOTS ASSOCIATION

open to all pilots—private, business, airline, military

Out of a long-felt need for a truly democratic organization of pilots representing all segments of the flying fraternity, has emerged the National Pilots Association, Inc.

★ ★ ★

NPA, now with headquarters in New York, will soon have a full staff and office in Washington to represent the particular interests of all who fly aircraft.

NPA will help give added representation to that already in effect, to combat any encroachments on our rights as pilots to use the airspace.This much-needed pilot's organization, operating in a democratic manner, will give added weight and forcefulness to the efforts already undertaken by various other organizations.

In addition, NPA plans an active program of aviation development to encourage the use of aircraft for business and pleasure. It hopes to sponsor national, regional and local flight activities — tours, navigation and efficiency contests. It will work closely with the National Aeronautic Association which is the official USA representative of the Federation Aeronautique Internationale, the world-wide governing body of sporting aviation.

NPA will refrain from profit-making operations such as insurance sales, premiums, magazine subscriptions and cut-rate merchandise offers. NPA will work with and not against manufacturers and operators. NPA will have an annual meeting open to all members at which officers will be nominated and elected in a truly democratic manner.

NPA's Founders

NPA was instigated by some of America's best-known and most active pilots in all spheres of aviation activity. Originators include:

Robert N. Buck, Captain, TWA, International Division. Former Transcontinental record holder and well known writer. (1st VP of NPA)

Leighton Collins, Editor and Publisher of Air Facts magazine. (2nd VP of NPA)

B. Allison Gillies, San Diego, Calif. Well known private pilot of 31 years experience. (Director of NPA)

George Haddaway, Editor and Publisher of Flight magazine. (Director of NPA)

Dwight P. Joyce, President of The Glidden Company, Cleveland, Ohio, private plane owner for many years. (President of NPA)

A. Paul Vance—Monsanto Chemical Corp., St. Louis. (Director of NPA)

William J. Junkerman, veteran Naval pilot, well known aviation attorney. (Secretary of NPA)

George Galipeau, Amherst, Mass., Vice President, Van Dusen Aircraft Supplies, private pilot of 20 years experience. (Treasurer of NPA)

Why You Should Join NPA

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Convair YC-131C

(*Continued from page* 10)

A horizontal firewall was installed to shield the structural wing box from the hot part of the nacelle and to prevent contact of the exhaust gas with the wing structure and landing flaps.

This arrangement resulted in a conventional three-zone nacelle. Each of the sections was equipped with a continuous-type fire-detector system and a Chlorobromomethane (CB) fire-extinguisher system. Increased nacelle volume, plus changes in airflow through the nacelle due to altered engine requirements, necessitated a redesign of the existing fire-extinguishing system to provide sufficient agent to meet the requirements of MIL-E-5352A. Essentially, the difference between the original system and the new system lies in the weight of the agent dispensed in a single shot—22.5 lbs for the 340, and 38.0 lbs for the YC-131C. Two 22.5-lb containers, located in the left-hand wing fillet of the Model 340, were replaced with four 19.0-lb speres, with two installed in each wing fillet. This new system provides three-zone coverage as compared to the two zones previously neutralized. However, the methods of discharging the agent, discharge indication, agent routing, and agent distribution remain essentially the same for both installations.

The pedestal in the cockpit was altered by the installation of new power and propeller controls. The power lever incorporates a "lift-to-taxi and reverse" feature at the flight idle position. Pilot and copilot have individual power-control levers and one set of condition or feather levers located at the center of the quadrant. In order to make an air start or unfeather operation, the condition levers are pushed forward of the normal run position until engine operation is regained.

The center engine instrument panel was revised to replace all reciprocating-engine instruments with units meeting gas-turbine requirements. All other panels remained as in the commercial Convair-Liner.

In order to accommodate the increased horsepower provided by the Allison turboprop engines over the R-2800 reciprocating engines used in the commercial Convair 340 (3250 equivalent hp each *vs* 2400 hp each), we had to increase the area of both the fixed and movable tail surfaces.

The span of the horizontal stabilizer was increased by 40 inches. This was accomplished by splicing a 20-inch extension on each tip. The stabilizer-root fittings and associated structure in the fuselage had been designed to accommodate the loads due to the increased area so no fuselage structural changes were necessary. The height of the fin was increased 12 inches in the same manner.

The new rudder had a 25% increase in area, and the new sealed-balance elevators were increased 22% in area. Servo and trim tabs were redesigned accordingly.

The existing surface-control systems were found adequate in strength and power to suit the increased loads.

Upon completion of the tail-fabrication work, proof tests were conducted on the fixed and movable tail surfaces and on their control systems.

The cabin pressurization and air-conditioning systems were retained in the commercial form with a few exceptions. Owing to mechanical incompatibility, the AiResearch primary compressor was replaced with a Stratos S-60-5B compressor driven directly from a right-hand engine accessory pad. The air is conditioned in the same manner as on the Model 340, the only exception being that engine bleed air is used as a primary source of heat for the heat exchanger instead of hot air from around the engine exhaust augmentors.

The cabin-pressure system is designed to supply occupied compartments of the airplane with an airflow of 73 lbs per minute at sea level, and 55 lbs per minute at 20,000 ft. It will hold a sea-level cabin altitude up to an airplane altitude of 8900 ft. At altitudes above 8900 ft, a maximum pressure differential of 4.16 psi is maintained. This corresponds to an 8,000-ft cabin pressure at 20,000 ft. By pre-setting cabin pressure controls, rapid rates of climb or descent can be made with a minimum rate of change in cabin altitude. Flow is maintained automatically against all normal loads imposed upon it by changes in demand for pressurization and refrigeration. Outflow from the cabin is controlled by the cabin pressure regulator.

For cabin heating on the Model 340 airplane, hot air is taken from the engine-exhaust augmentors, passed through the primary heat exchanger to heat the cabin ventilating air, and is then discharged overboard. This method is retained on the YC-131C airplane except that the hot air is taken from the engine compressor. Since the compressor bleed air has sufficient pressure to flow through the primary heat exchanger at any time the engines are running, it is not necessary to operate the ground ventilating fan to obtain ground heating as required on the Model 340.

The heating-air ducts also function as starter manifold ducts when the starter arming switch is engaged. This permits the starting of one engine from the other operating engine. A ground-service air connection for engine starting is located in the RH wheel well.

The Convair 340 electrical system was adapted to meet the requirements of the YC-131C airplane by modifying existing electrical panels, racks, junction boxes and wiring. Additional equipment required consisted of 1) an equipment rack in the upper forward cargo compartment for the two temperature datum control amplifiers and the two propeller governor amplifiers; 2) a 1500 volt-amp, three-phase inverter installed just forward of the two existing inverters for propeller feather pump motor power and as an alternate power source for engine and propeller-control amplifiers; 3) a fuse panel for the added inverter located forward of the lower cargo compartment.

Performance

The commercial Model 340 was designed structurally for a maximum weight of 53,200 lbs. The present airplane is certified by the CAA for a take-off weight of 47,000 lbs and a landing weight of 46,500 lbs. Since the purpose of the airplane was a test vehicle, no necessity existed for increasing

the gross weight of the airplane.

The published power on the production T-56 engine is 3750 equivalent shaft horsepower for take-off rating. The YT-56-A-3 engine in the YC-131C has been operating at an Air Force restricted power below this value. With the production Allison specification power, the YC-131C will have a top speed of 338 knots. This speed will be obtained at 25,000 ft with military power and a 43,000-lb average gross weight. The range at an operating speed of 287 knots with 80% normal rated power at 30,000 ft and full fuel will be 1,710 nautical miles.

The service ceiling (rate of climb 100 fpm) with two engines operating is 36,300 ft and with one engine is 18,000 ft. A take-off at 47,000 lbs gross weight should require 2,710 ft to clear a 50-ft obstacle. Landings have been made in which the use of reverse thrust resulted in a landing roll of 700 ft.

The potential of the airplane at 53,200 lbs take-off weight allows considerable increase in performance. By adding more fuel in the wing and with wing-tip tanks, the all-out range can be increased to 3,000 nautical miles. Even with a 24,000-lb payload, a cargo version would have a range of 1700 nautical miles.

Comparing the performance of the YC-131C with the Convair-Liner is not easy. Comparable cruise conditions involve entirely different engine power settings at different airplane altitudes. If basic assumptions of equal airplane weight, actual airline cruise power on the reciprocating engines, advertised cruise power settings on turboprop engines, and optimum altitudes for each type are assumed, a comparison would make the YC some 75 mph faster.

Flight-Test Program

The Convair flight test program on No. 1 airplane consisted of 23 hours of flight and was accomplished in 11 flights. Sufficient instrumentation was installed to indicate and record all critical temperatures and pressures within the nacelle. Elevator and rudder-force instrumentation also was utilized. After completion of the first 10 hours of testing, a further program authorization permitted the installation of more complete engine instruments to evaluate engine power and exhaust thrust, as well as an engine inlet-duct pressure survey.

Although this program was considered relatively trouble-free by Convair, we ran into a few of the normal headaches.

The biggest difficulty was failure of turbine-bearing seals. This condition was the result of a carbon-like deposit on the seal retainer resulting in sticking of the spring-loaded carbon seal and consequent rapid loss of oil from the engine. Fortunately, the engine manufacturer evolved a fix very expeditiously and the program was able to continue after factory rework.

On this particular prototype model of the T-56 engine, it was found necessary to monitor vertical displacement due to turbine-wheel vibration. The allowable amplitude of this vibration was limited by the engine manufacture to 4½ mils. The out-of-balance condition occurred only after initial engine start and was believed due to uneven heating of parts of the engine turbine section. When this vibration was excessive, an engine shutdown followed by a re-start usually cleared up the trouble.

One of the design features thoroughly tested during the program was the propeller auto-feathering system. This system was designed to eliminate the aerodynamic drag of a windmilling propeller in the event of engine failure during take-off. As you all know, the power absorbed by a windmilling prop driving an inoperative turboprop engine is many times the magnitude of that associated with driving a reciprocating engine. The auto-feathering operation on this airplane is initiated by a speed-sensitive switch driven directly by the engine. When engine speed drops from the governed 13,820 rpm to a lower value of approximately 13,000 rpm, this switch operates to initiate propeller feathering and fuel cut-off, providing the system is in the manually "armed" condition.

This system was operated numerous times during simulated take-off configuration. Each time the propeller feathered without hesitation and with no attention required.

Summary

We at Convair are enthusiastic about the potentialities of the turboprop powerplant. We like its light weight, simplicity of installation, and ease of operation. We observed a trend during our relatively short flight program toward a very drastic reduction in engine maintenance. Our pilots have expressed satisfaction with the flexibility of operation of the powerplant.

In short, we believe the turboprop powerplant has a definite place in the commercial and military transport field. At the same time, however, we believe that only through continued performance, flight-testing and accelerated service testing will this type of powerplant reach the degree of reliability and consistent performance of present-day reciprocating engines.

Skyways Round Table

(Continued from page 17)

Now we go into pressure suits which are a great advance but not an improvement in comfort for the pilot. From what you are saying, there's nothing else on the horizon as yet."

Jerry Lederer: "*Another phase of test flying is the instrument problem. What is your feeling regarding the adequacy of instrumentation for navigation and flying, not the actual test instrumentation?*"

E. M. Beattie: "There is a radio communication problem and also one of lesser importance in radio navigation. Using VHF or UHF for communications at high altitudes, your interference from ground stations or other aircraft is as bad as HF ever was. If you are flying at 40,000 feet over Schenectady, for example, and using VHF or UHF, you can hear transmissions loud and clear from all stations on the same frequencies located anywhere in the northeastern part of the country. I find it a little difficult at 40,000 feet to report accurately within several minutes my time over a station. You can hear three or four fan markers, an outer and middle marker and a Z marker simultaneously for quite a period. During that time, the ADF rotates idly and the omni, of course, is no more accurate."

Jerry Lederer: "*Are you apprehensive about any collision hazards at high altitudes? Is there any traffic to worry you?*"

Tex Johnston: "That is a function of the area in which you are operating and the activity in that area. As far as I am concerned, we do have a problem with our own traffic. It's not unusual for us to have six B-52's and maybe two B-47's in the air simultaneously, and the type of test work we do requires us to record everything that goes on, for coordination purposes with the people on the ground.

"When operating at present-day speeds, your closure rate is terrific. On days when you have vapor trails, it isn't much of a problem, but when you haven't, we make a practice of calling around and trying to keep each other informed of the locale in which we are operating. The area actually is quite restricted because we have to stay within radio-contact range. A lot of testing today is telemetered, and the telemetering range is even worse than the radio range. You can't operate beyond 100 or 150 miles of your base and be sure you are making contact on the telemetering operations. Therefore, that loads up the area considerably.

"I had an experience just last week. Two weeks ago I wrote a memo to all pilots pointing out that inasmuch as for the past two years we had had only two airplanes operating at these altitudes (the XB-52 and the YB-52), we had become a little lax. I cautioned them that now that we had so many more airplanes, we had better start watching it. So, one day last week I was at altitude and operating in a zone from the Canadian border to a point a little south of the Oregon-California line. That's about umpteen square miles of airspace. We had three airplanes up there in comparatively close range. One was at an angle and if he hadn't been, I wouldn't have seen him at all! Fortunately, it was a day when there were contrails. It was pretty close!"

Jerry Lederer: "*Have you thought of artifical contrails?*"

Tex Johnson: "Yes, we have, but frankly, Jerry, you have so many maintenance problems in getting your airplane ready to go, keeping your instrumentation operating, etc., that you hate to add anything else to the picture. The cost of the flight-test hour today is rough, and anyway the use of artificial contrails would depend a lot on atmospheric conditions."

Duke Krantz: "Can you tell us something about how you navigate? I know there are now maps covering jet navigation only, but I haven't had a chance to look at them as yet."

Tex Johnston: "We're in a rather envious position up where we are located in that we have some awfully good landmarks. We never clear a test under instrument conditions unless it is an icing test or something that actually requires instrument conditions. We wait for contact weather. Now that doesn't mean that we don't operate if there's an overcast; we operate much of the time 'on top,' but the greatest percentage of the time the overcast is such that the peaks go above it and you can use them for landmarks. On days the peaks are obscured, we just don't go 'on top' unless there are holes over some area so that we can go down through. If the holes close up, we knock it off and quit flying. We also use omni."

Herbert O. Fisher (*Chief, Aviation Development, Port of N.Y. Authority*): "Our business at the Port Authority is providing adequate runways for all types of aircraft to land on with a reasonable margin of safety. From that safety standpoint, both from approach, landing and roll-out, just what tolerance can we expect out of jet transports in the future? How much control tolerance would the pilot have on final for a possible go-around? And will the jet transport require longer runways than we now have? We believe all new aircraft should be designed so as to assure satisfactory performance within the limitations of TSO-N6A which provides for runways 8400 feet long at intercontinental express airports."

Tex Johnston: "A quick answer, Herb. Yes, we can operate the Boeing 707 in and out of any airport that meets the requirements of our present transport aircraft. The 707 goes faster but that doesn't mean that its low-speed characteristics have changed. Our approach speeds are comparable with those of presently operating aircraft. Our wheel loading also is comparable, and the acceleration characteristics of the engine we are utilizing is such that a go-around is no problem, even under minimum instrument conditions when you are not lined up with the runway and you want to go around and are down at a very minimum altitude. Your holding patterns will be the same and you'll use the same airspace for a holding pattern that you use today in the DC-6 or the Connie or the 377 . . . or any of the others."

Duke Krantz: "How about fuel consumption during all this time?"

Tex Johnston: "That depends on the number of go-arounds. Any commercial operator using this type of aircraft would set up certain minimum fuel quantities so that the pilot can go to an alternate in case he can't get in at his intended destination. But if the pilot wants to take a couple of shots at the field, that's entirely possible. Everyone knows that jet engines use a lot more fuel at low altitudes. Therefore, you can't stay at low altitudes indefinitely."

Duke Krantz: "You mentioned full power after application of power when you're coming in for an approach. Do you have a chance to go around once you miss your approach?"

Tex Johnston: "I'd say the condition is no different than if you were flying a DC-6 or a -7, a Connie or a 377."

Duke Krantz: "You'd have about 50% power on at all times during the approach?"

Tex Johnston: "It's the same as with a reciprocating engine. With the Pratt & Whitney on the 377 or the compound engine on the DC-7, your power response to throttle application is 4 seconds from idle rpm to maximum thrust. On your J-57 jet engine your power response is approximately 7 seconds from idle, and we all know that you don't make many transport approaches power off. At the most the differential is a couple of seconds."

Jerry Lederer: "*Mr. Bedell, what about the use of arresting gear for airports? I understand you use one at Grumman.*"

William Bedell: "For our type of operation, they are indispensable. We've had several 'saves' with it. It's good for test operations and might work out for a commercial airport, too. We have a cable strung across the runway, similar to that on a carrier deck, and if you've blown a tire and have lost your braking action, you can get the tail hook down. Of course, this only applies to carrier-type aircraft."

Jerry Lederer: "*I believe nets are being put up at some airports.*"

William Bedell: "The Air Force has been doing that, but I'm not familiar with it."

Herb Fisher: "In our program of keeping up with developments in airports and aviation in general, the Port Authority's Aviation Planning and Engineering Department has visited several companies that are producing cables, nets and other devices for stopping fighter and transport aircraft after touchdown. While there are some operating difficulties involved in the mechanism, it could easily save an airplane that is over-shooting."

Tex Johnston: "Inasmuch as you are associated with airport facilities, Herb, I'd like to bring up an experience I had and get your thinking on it.

"I had a brake failure not too long ago on a field with a 10,000-foot runway. I still had steering, but absolutely no braking. I elected to traverse off the runway in an effort to ground loop at the end of the field to prevent hitting obstructions and ditches that always are at the end of runways. The operation would have been successful if the terrain adjacent to the runway had been properly maintained. I made a turn to the right of the runway, but my speed was such that the steering wouldn't corner. I didn't have enough cornering on my nosewheel to make the run to the right at the radius I needed to avoid obstructions on the right side of the field. So I went as far as I could that way and then started a turn to the left, judging the radius of the turn to avoid the ob-

structions on the left side of the field. Except for one condition, I would have made it and the airplane wouldn't have been damaged at all. But, I got beyond the threshold of the runway, beyond the end of it, and it was completely unmaintained. The last contractor who had done cement work on the runway had dumped some excess concrete, and I centered it right square on the nosewheel and took it completely off.

"I feel very strongly about the airport maintenance problem, and we're doing something about it at our field. We are maintaining the areas adjacent to the runway, particularly at both ends. That is something that might save accidents and damage. The turf should be smooth and well packed so you don't sink in."

Herb Fisher: "Aside from one or two ends of a total of six runways, we have adequate overrun area at New York International Airport. The overrun area happens to be sand-type ground, so you could run off the end of the runway without fear of piling up."

Tex Johnston: "It has to be more than just the ends of the runways. If you're going to have to ground loop, you'll be making a circle in one or the other direction and that covers quite an area."

Herb Fisher: "You still could run off the runways at New York International and not have to worry about ground-looping, because of the sandy terrain around it."

Jerry Lederer: *"Is there any means of exchange of test-flying information between companies? It would seem to me that such an exchange would be very useful."*

Herb Fisher: "From my 16 years experience in this flight-test business, I'd say there always has been a definite lack of that sort of thing. The test pilot groups of each of the companies have never had an organized annual or semi-annual meeting to discuss their mutual flight-testing problems. I know of only one or two sessions in which a few test pilots got together to really discuss their problems. I think that is one of the important things we lack in this industry."

Duke Krantz: "Perhaps it's because there is a good deal of professional jealousy between companies."

Herb Fisher: "That may exist, but I have never felt there was professional jealousy between pilots. Obviously, there is certain company security to be maintained, but as far as practices and techniques in test flying, the dissemination of such flight-test information would be invaluable to the industry as a whole and it would increase safety and confidence in this profession."

Jerry Lederer: *"I'd like to point out that the North Atlantic Treaty Organization does have semi-annual meetings of test pilots from the various countries, and these are very informative meetings. It can and perhaps should be done here."*

L. L. Brabham: "Back in 1942 or '43 we had a test pilots meeting at Eglin Field. The Air Force pilots were there, and so were Navy pilots and pilots flying for the contractors. At that time we said that such a meeting was going to be an annual event, but the last one was way back in '43. I think we should start it again."

George Wies: "It would be a wonderful

(Continued on page 40)

Skyways Round Table

(*Continued from page 39*)

thing if the pilots could get together."

Herb Fisher: "The Air Line Pilots Association meets at least once a year, and at that meeting the pilots really sit down and discuss their problems. One of the best things that could happen would be for the bonafide test pilots to hold a yearly meeting. We don't want each other's secrets, we just want to get together, share experiences and help develop the highest degree of proficiency and safety."

Jerry Lederer: *"By way of summary, gentlemen, I think you'll agree that this discussion had brought out 10 very important points, eight of which indicate a definite need for improvement in the facilities and equipment employed in test flying, and two of which show areas of no-problems in the successful operation of jet aircraft. Certainly, these two points are encouraging in the consideration of airline jet-transport operation.*

"The points are:

1. *"The need to improve personnel survival gear is most urgent. Test pilots do not trust what they have now; they find it restricts their movements; causes discomfort prior to take-off, and danger later unless the cabin is air-conditioned while the pilot is going through pre-flight checks.*
2. *"Test pilots would like to know what research and development is underway to improve their survival gear.*
3. *"Safety belts and shoulder harnesses need improvement, and the question is, what has happened to Col. Stapp's developments?*
4. *"The collision hazard is serious in test areas although contrails do help.*
5. *"Areas adjacent to runways should always be kept clear of obstructions and should be usable in test operations in cases of emergency.*
6. *"Test pilots definitely lack a means of exchanging information on their mutual safety problems.*
7. *"Communication and navigation is inadequate at high altitudes. Pilots cannot identify their positions precisely. Also, communication interference is very evident at high altitudes.*
8. *"Arresting gear on the airport is indispensable for test work safety.*
9. *"Jet transports should offer no more operational problems than do our present modern air transports.*
10. *"Go-arounds with jet transports will be no problem.*

"Gentlemen, I thank you for joining in this discussion, and I'm certain I speak for you in thanking SKYWAYS for making these profitable meetings available to us. We know they are helpful."

Fuel Tank Resealing

(*Continued from page 13*)

access plates, fuel pumps, liquidometers, all joints and line connections.

4. Filling and Draining Operation

a. Close the fuel tanks.

b. Fill the tanks with fuel to capacity.

c. Inspect the exterior of the tanks for evidence of leaks.

d. If no leaks are apparent, drain the fuel.

e. Install fuel pumps, liquidometers, sump assemblies, etc.

f. Attach the inspection access plates.

5. Air Pressure Test

a. After spraying the interior with leak detector, fill the tanks to capacity.

b. Apply two pounds of air pressure.

c. Inspect the fuel tanks for evidence of leaks on the wing's exterior surfaces.

6. Final Repair

a. The final tank work can now be performed, *i.e.* surface application of sealant.

b. Spray the underside of the tank area with aluminum lacquer to assist the sealant on the exterior.

Air Pressure Test: The air-pressure test is performed as part of the major overhaul operation. The use of the air test must be performed carefully and requires the use of an air hose, an accurate low-pressure air gauge, a source of compressed air, and an air-leak detector. On attaining a pressure indication of two pounds on the air gauge, a pressure pot spray gun is filled with a leak-detector fluid at a predetermined ratio. This material is sprayed on the interior of the fuel tanks prior to filling and applying air pressure to the fuel tanks. When the fuel tanks tend to leak, this material starts a bubble action on contact with the air and makes it possible to detect a leak on the exterior. Be certain no leaks occur on upper surface of the wing.

There are certain safety precautions to be observed in use of the air-pressure check on the fuel tank. If a mercury barometer is used, it should be kept *away* from the aluminum alloy structure. All lighted extension lights should be flameproof and kept away from the tank interior. Sufficient heat can be generated by a lighted lamp to change the air pressure. The air gauge or manometer is used to make sure the pressure does not exceed two pounds per square inch. A quick disconnect fitting should be applied to the pre-set needle valve so that in event of failure of the valve, the air-pressure supply can be released quickly to relieve the tank.

Accessory Work: The previous tank-sealing operations are performed on air transports having integral fuel tanks. In conjunction with the fuel-tank sealing operations, all supply-line operations, all connections to the fuel-tank selector valves should be checked for a tendency to leak when the tanks are topped off with fuel. Such imperfections as damaged threads, imperfect rivet heads and leaking fuel valves should be noted and corrected. Fuel-selector valves should be checked.

Summary: An analysis of the various operations as has just been detailed will enable a prospective customer to obtain an approximate idea of the amount of money which must be expended to obtain a good tight tank-resealing job. On some air transports, the *Lodestar*, for example, depending on the model and fuel-tank system, a tank sealing job may run as high as $8,000. On a Twin-Beech, a tank seal might run between $750 and $900.

now hear this . . .

(*Continued from page 6*)

tute of Technology. One grant is offered toward the construction of the Karl Taylor Compton Laboratories; two are one-year fellowships at the Massachusetts Institute of Technology.

Contracts to provide three months' airlift service to the Far East, Europe, North Africa, Alaska and Greenland have been awarded by the Air Force to **Overseas National Airways, The Flying Tiger Line,** and **Slick Airways.**

Flight Refueling recently opened new testing facilities at Friendship International Airport, Baltimore. The facilities are for research and development in the techniques of inflight refueling of aircraft.

Solar Aircraft has formed a new British corporation, Sugg Solar Ltd., to manufacture and market Solar Aircraft Company's gas turbine engines.

Lear, Inc., Grand Rapids Division has been awarded new production contracts totaling over $15 million for instrument products.

AC Spark Plug Division recently announced five new aviation distributors in the U. S. and Canada. They are Pacific Airmotive, Southwest Airmotive, Airwork Corp., Van Dusen Aircraft Supplies, and Standard Aero Engine, Ltd.

AERO CALENDAR

June 4—First Int'l Air Show, in conjunction with Eighth International Trade Fair, Toronto Flying Club, Toronto, Can.

June 5—Dedication Huron Aviation Club, Dawn Patrol, Huron Memorial Airport, Bad Axe, Mich.

June 12-17—SAE summer meeting, Atlantic City, N. J.

June 18-25—Third Annual Transcontinental Air Cruise. Palm Springs, Calif. to Philadelphia.

June 21-24—ADMA Mid-Year Meeting. Brainerd, Minn.

June 21-24—IAS and RAS joint meeting, Los Angeles.

June 23-25—Institute of Navigation annual meeting, Maxwell AFB, Alabama.

July 2-6—Ninth Annual All-Women's Transcontinental Air Race. Long Beach, Calif. to Springfield, Mass.

Aug. 5-7—Third Annual "Fly-In," Experimental Aircraft Association, Curtis-Wright Airport, Milwaukee, Wis.

Aug. 10-14—Air Force Association convention and Air Power show. San Francisco.

Aug. 19-21—Second Annual "Fly-In," Antique Airplane Association, Ottumwa Airport, Ottumwa, Iowa.

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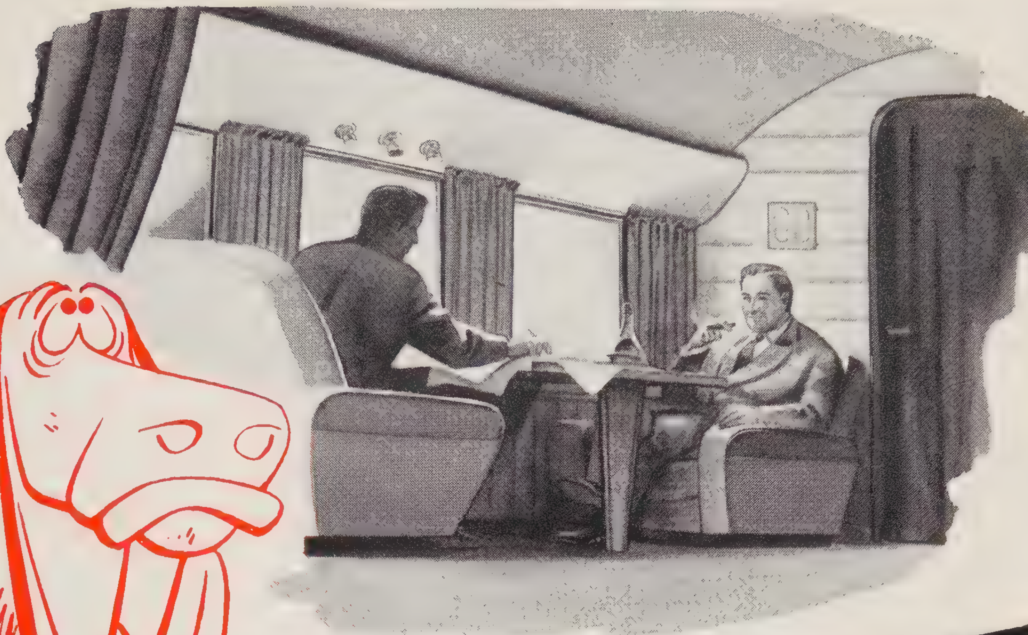

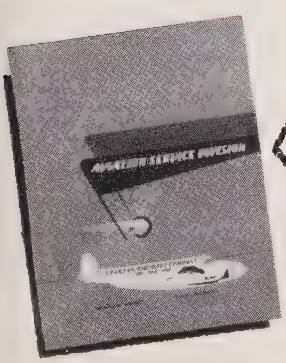
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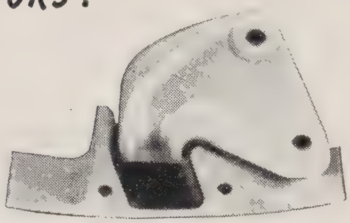

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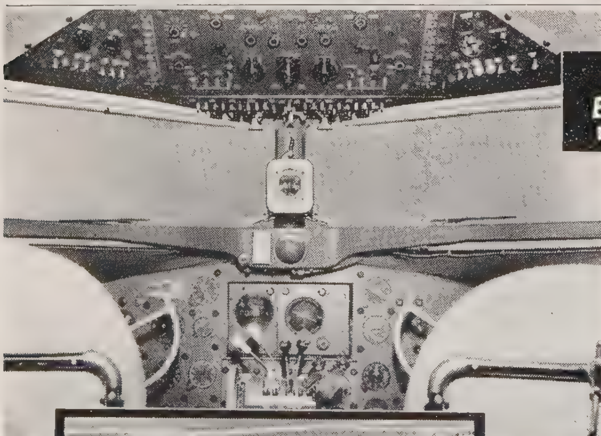

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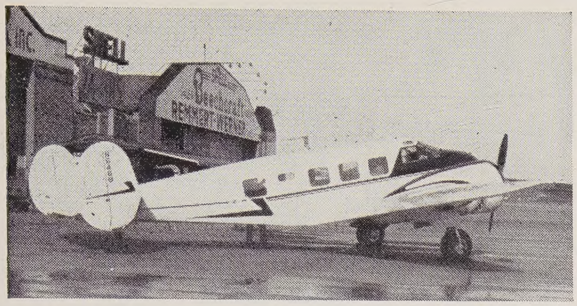

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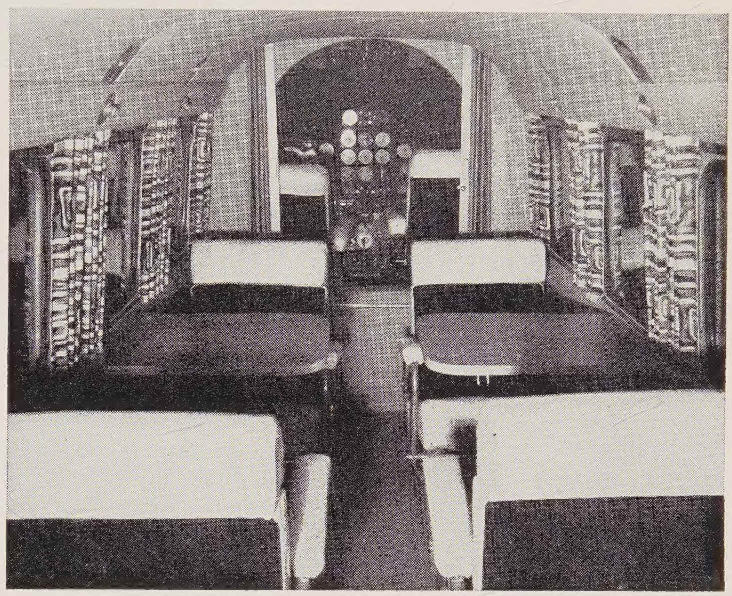

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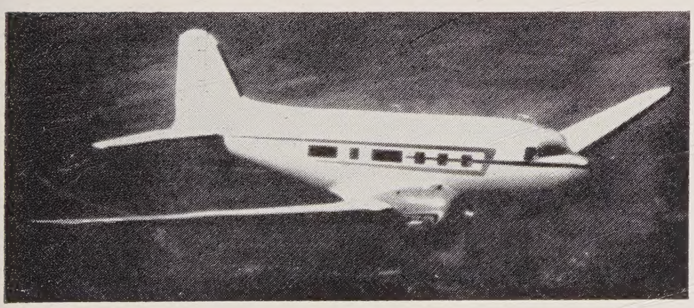

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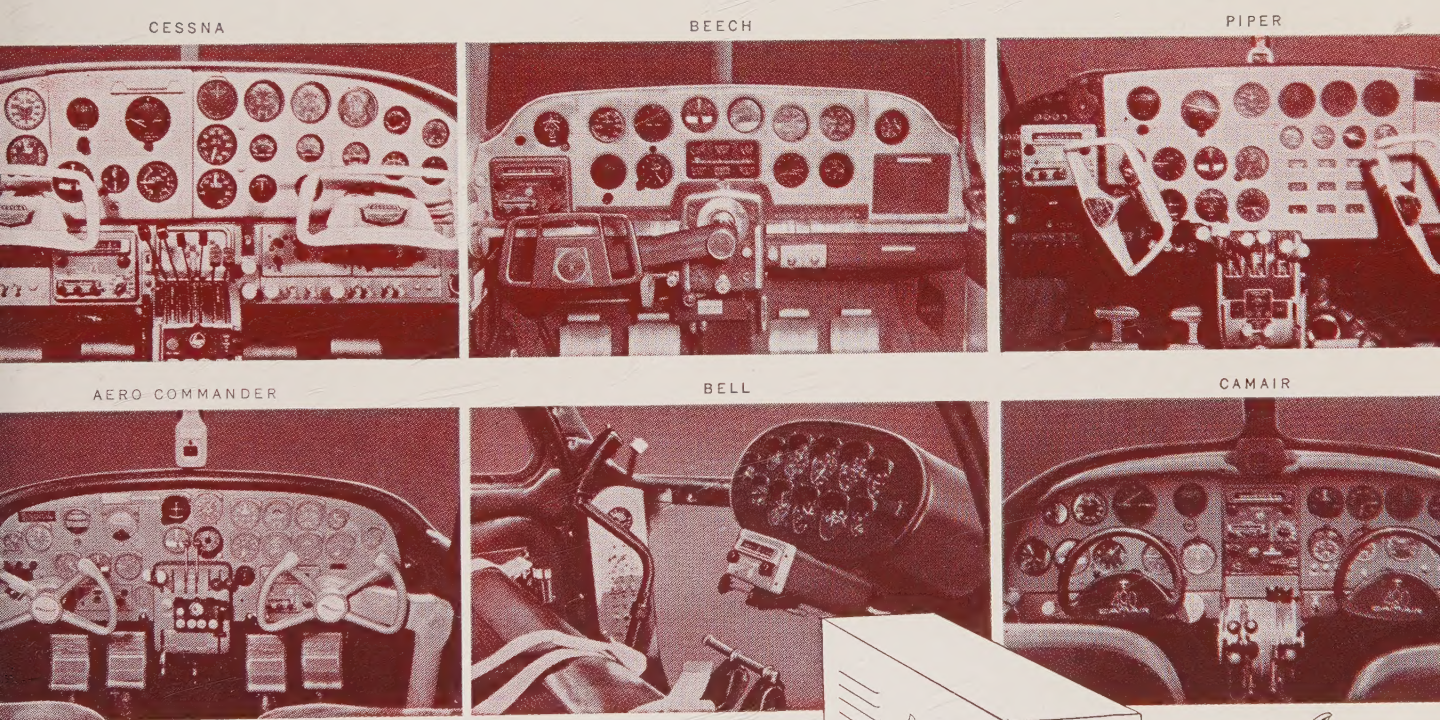

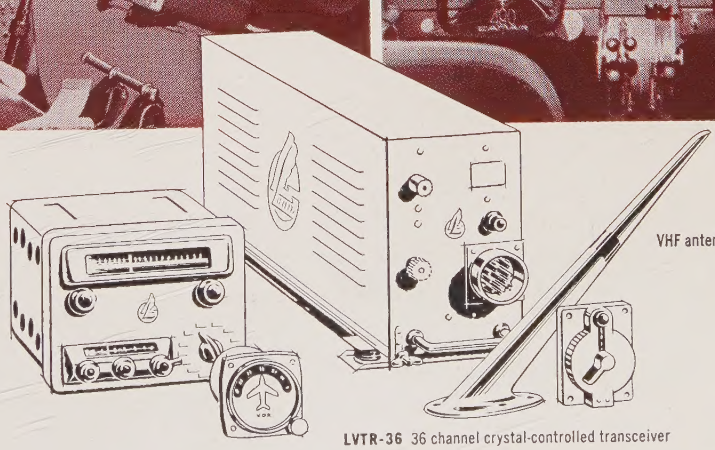

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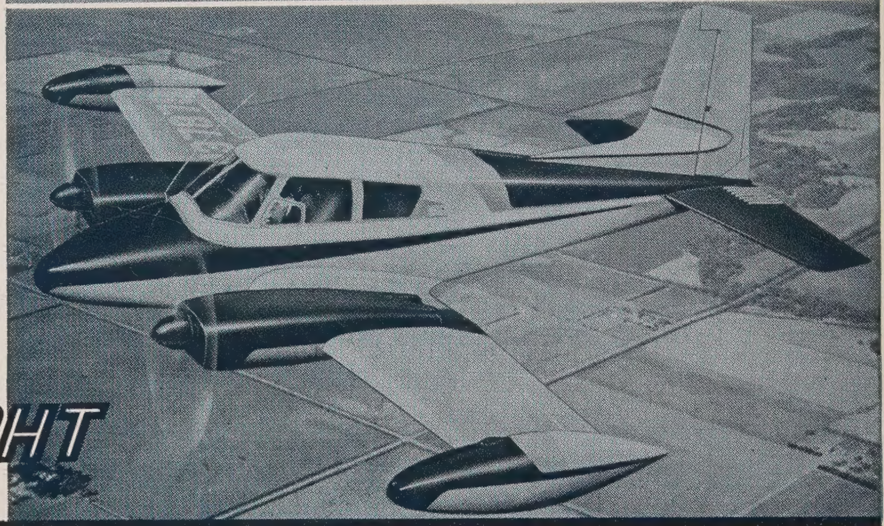

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